UNIVERSITY OF CAPE TOWN

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"Risk management in the cost planning and control of building projects

The case of the quantity surveying profession in Kenya"

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DECLARATION

The content of this thesis is entirely my own work, except for the specific and acknowledged reference to the published work of others.

I confirm that no part of this thesis has been submitted to any other institution for academic award of any kind.

Signed at................................ the............. day of................ ... 2005

Githae WANYONA ....

ABSTRACT

This thesis examines financial risk management in the cost planning and cost control of building projects in Kenya.

The quantity surveying professional in Kenya is faced with poor access to the recorded cost data needed for preparing final building cost estimates and for budget prediction. This shortcoming is exacerbated by the passive role played by the professional building cost consultant during design development. Passive professional building cost consultants are unlikely to implement risk management strategies as part of the cost planning and cost control process. The proactive identification of risks and their outcomes is essential for budget prediction and for estimating future risk impacts. The need exists for a generalised procedure that can use the limited available project information, adapting it to specific projects through identified risk indicators such as risk groups, clusters and broad subsets.

The primary objectives of the research project were to identify the characteristics of risk in current practice of cost planning and cost control of building projects, and to investigate the efficacy of the techniques employed to assess risk and risk impact in cost prediction. Identifying significant cost contributors to building budget is essential when assessing and evaluating risk for cost planning and control. The research examines the knowledge and experience of professional building cost consultants, the budget prediction procedures employed in the Kenyan building sector, and risk management in budget prediction for building projects.

The research was conducted through a review of literature, a questionnaire survey and case study interviews.

The findings emanating from the research were that intuition/judgement/experience was the only method of risk analysis currently used to identify and quantify risk impacts during risk management in budget prediction in Kenya. The most important risk factors considered in risk management at the budget prediction stage were bills of quantities, the quality of design information, brief uncertainty, completeness of design and conditions of contract. Suggestions for improved risk management in cost planning and control of building development are proposed.

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Publications associated with the thesis

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Technology and Management for Sustainable Building Workshop and Conference at CSIR Pretoria. RSA.May, 2003. pp. 200-210.

"Risks in proactive budget prediction: An empirical study in Kenya".
The First Scottish Conference for Postgraduate Researchers in the Built and Natural Environment (PRoBE) Glasgow Caledonian University, City Campus, Glasgow Scotland. November 2003.

"Managing Anticipated Risks in Project Procurement System – A review and future directions for infrastructure construction"
CIB W92 International Symposium on Project Procurement for Infrastructure Construction Chennai, India, January 2004.pp. 72-82.

"Factors influencing risk management in cost planning and control of building projects".
International Cost Engineering Council (ICEC) 4 th World Congress, Cape Town, RSA April 2004. ICEC World Congress April 2004,pdf file pp 1-13.

"Exploring case study method as a tool for financial risk management in the Kenyan building sector"
Paper presented at the Construction Industry Development Board (CIDB) Conference, Cape Town, South Africa, 10-12 October 2004.pp 298-309.

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CHAPTER 1

General Introduction

1.1 Background to the problem

The process of property development typically entails constructing new facilities on undeveloped land, or the redevelopment of existing buildings; essentially it involves the operation of bringing an idea or concept to successful completion (Wurtzebach and Miles, 1987). Since property developments vary in size, type and complexity and each property delivers its own set of problems and characteristics, the development process is complex in nature and considerable expertise is required to conclude a successful project.

In Kenya, building clients, both in housing and public buildings, continue to experience cost overruns on set budgets, which has proved to be a serious and costly problem (Omondi, 2000). For example, the cost of the Kenyatta International Conference Centre (KICC Building), which is a landmark building in Nairobi, was initially estimated at KShs 22 million in 1970 but this figure had risen nearly four-fold to KShs 80 million by the time it was completed in 1973 (Opala, 1999). The National Social Security Fund (NSSF) Building, Loita House (Kisero, 2001) and the Weithaga Coffee Co-operative Society Building (Wamwati, 2001) exceeded their original budgets by 140 per cent, 156 per cent and 70 percent, respectively.

Cost and risk management problems in budget prediction, such as the 'projects cost estimates' for projects in Kenya and other similar countries, have been a challenge in developing countries with a short history of large and complex building developments. Okema (2000) and Al-Momani (1996) highlight similar problems in Uganda and Jordan. Adams (1997) found that local contractors in the Nigerian construction industry had similar problems with the project budget. Even in countries such as Britain, Greenwood (1997) and Jackson et al. (1997) reported on similar research issues where construction clients said their projects finished significantly over budget.

Ultimately, not only do many projects exceed their budgets, run late or fail to meet cost objectives (White and Fortune, 2002) but, according to Diekmann (1997) in a study of environmental projects, projects can encounter multiple physical sources of uncertainty. He found that, as a result, only 46 percent of the projects were completed on budget, 47 percent were over budget, and 7 percent were under budget at completion. Case studies by Al-Momani (1996) have also established that many instances of non-physical external factors, such as design changes or funding problems, cause cost overruns in various ways.

It is important that there should be an obligation on the quantity surveyor to take the lead in identifying the real issues that impact on building costs and on risk management. In addition, they must make informed suggestions on how to solve the cost disparity between initial budget estimate and final building cost.

Cost practitioners need to improve current practices of risk management in cost planning and control at the early stages of a project. The Kenyan experience in cost budget overruns is a typical example of that observed in countries where the planning of risk issues associated with cost estimates is seldom explicitly quantified when forecasting building costs. In traditional cost planning and control, the primary consideration relates to the possibility that adverse events may occur in the development process and introduce unforeseen expenditure that causes predetermined budget forecasts to be exceeded. In contrast, clustering and grouping of risk would aid risk management and assist in assessing risks in building projects since traditional methods seem to be inadequate.

Much literature has been published on the topics of risk management and cost planning and control in countries with well-developed building industries – see for example Chapman (2001), Ward (1999), Bowen (1993) and Flanagan and Norman (1993). Scant consideration has, however, been directed towards the risk management function in cost planning and control of construction projects in countries with developing building environments, and the factors affecting them.

A considerable amount of construction research has focused on the opinions of the professionals – contracts and tenders in the industry and the contractor's perception being based on the contractor's costs and not on the client's point of view. Some research in risk management, cost planning and control has originated from South Africa (Nkado, 2000; Bowen, 1993), Uganda (Okema, 2000) and Nigeria (Adams, 1997), but little construction research in risk and its management has originated from Kenya.

It had been shown by researchers, for example Akintoye and Fitzgerald (2000), Mak et al. (1998) and Macsporran and Tucker (1996), that errors in assessing cost and design variations create irregularities that can extensively affect the overall budget prediction, particularly in countries with developing building industries. Moreover, elements of risk have to be incorporated when forecasting building costs (Kaka, 1996), but even then some important aspects of the process of risk management in cost planning and control seem to have escaped research attention. The client's cost and incomplete or inadequate information at the early project development stages, are some of the important aspects that have not received research attention. Cost and risk assessment from the client's point of view, abstract broad risk entities, selected risk clusters and assessment priorities could enhance risk management in cost planning and control, based on the most cost-significant risks.

In an empirical study of current practices, the involvement of project managers in project development and risk profiling often had an important bearing on the success of the budget prediction (Elkington and Smallman, 2002). Any future study should investigate a real-time study (projects in progress) with a view to gaining a greater understanding of the effects of the various processes interacting in budget prediction. This would build a more holistic view of the final building estimate and thus accommodate the effects of risk and quantification variability in budget prediction. (White and Fortune, 2002)

Although human and project characteristic variables appear to be fundamental to understanding risk profiles and risk management, including the cost assessment merit of the budget outcome of final building cost (see, for example, Al-Tabtabai et al., 1999; Liu and Walker, 1998), there has been little research directed to this area of risk management.

While the professional building cost consultant insists on having the information to determine the cost, these details are not available when the budget estimates are needed most. In spite of this, professional building cost consultants must attempt to identify the most important risks, to produce a credible building cost budget (Samid, 1996). In only a few isolated case studies has there been any in-depth investigation into risk profile, cost assessment merits and the information flows which forge the links between risk management, cost planning and control procedures (e.g. Edwards, 2001; Akintoye, 2000).

The lack of generally accepted budget guidelines and the limited exchange of information among project participants have contributed to ineffective budget prediction (Pender, 2001; Hegazy and Moselhi, 1995). Nevertheless, much of the research work, for example that of White and Fortune (2002) and Kim and Bajaj (2000), has been concerned with measuring the effectiveness of the budgeting process. This depends on the existence of adequate cost data, which is used to attain success in budget prediction, as well as to achieve the project cost objective (Liu and Walker, 1998).

Any opinion on a budget prediction process cannot carry much conviction unless it is judged against the final building cost.

The identification of factors of influence – such as natural and external risks, or contractual, client and professional team estimating – demonstrates the inadequacy of a using only budget prediction against the final building cost (Chapman, 2001; Liu and Walker, 1998). In other words, budget prediction cannot be improved without an empirical knowledge of risk factors and their sources. Most contractors work only from their own, often very limited, local experience.

Complexity in building projects, shifting requirements, the *ad hoc* management structure, and changes due to external factors have all resulted in a lack of research attention in the area of cost budgeting. Researchers have not sufficiently considered risk management and the effectiveness of the building budget in traditional cost planning and control.

Some examples of this are the following: based on an empirical model observed from construction reports of 125 school projects in Jordan, Al-Momani (1996) emphasised the importance of a cost prediction model. Kaka (1996) enhanced the flexibility of traditional cash flow forecasting in building projects in Britain by adding a further variable; Mak et al. (1998) applied risk analysis in capital cost budgeting using a project in Hong Kong as a case study; Al-Tabtabai and Alex (1998) approached the budgeting of construction projects in Kuwait and India with an artificial intelligence strategy for the optimum combination of project selection with experience. These researchers were all concerned with the probability of risk occurrences, yet probabilities and mathematical approaches alone cannot solve budget problems. There are some important aspects of traditional cost planning that appear to have escaped the attention of construction research.

Risks can diminish or increase during a project life cycle and the direction of change would depend on the type of risk and its source. A poorly coordinated project initiated with no prior cost plan might end up with a cost overrun. Effective cost planning could mitigate or avoid high risks impacts using the increased level of knowledge and documentation on risks.

This study presents the use of risk indicators, proactively derived from very limited project information, to streamline the budget process and facilitate risk management in the cost planning and control of building projects. The cost planning procedure helps the budgeting team analyse project risks so that potential problems can be mitigated or avoided, or transferred to a third party if the risk cannot be managed. In this way the budget can be increased in anticipation of such risks (Diekmann, 1997). The researcher hopes that his approach will deepen the fundamental understanding of risk management in cost planning and control and create new possibilities for both quantification and assessment of budget prediction.

Other related disciplines, such as financial management, have recognised that certain important aspects of risk and uncertainty do not easily lend themselves to analysis by probabilistic methods. There are some important aspects of building risk which probability theory cannot deal with, nor can it explain certain important aspects of observed project-management practices (Pender, 2001). A new approach is therefore needed to evaluate the effect of risk on budget cost prediction, and the insights gained from the author's considerable practical experience (more than two decades) of real projects, as well as his extensive knowledge of risk planning, can contribute towards this.

An adequate budget prediction structure should be able to prevent risk problems from arising, by creating an approach that can cope with scarce project and market information. This should make the assessment and quantification of risk indicators possible, even at early project stages. It is therefore important to be able to explain and predict risk indicators in traditional cost planning and control with tolerable accuracy. Dealing with the absence of risk indicators in traditional cost planning and control therefore represents the main focus of this research.

1.2 Problem statement

Cost planning and control is implemented to plan for and control building costs within specified budget limits. However, the literature, for example Al-Momani (1996), Bowen (1993) and Ogunlana (1989), indicates that the accuracy achieved by professional building cost consultants in forecasting building costs at early project stages does not meet the risk and cost planning expectations of clients. Two reasons are given for this: firstly, excluding meaningful risk management procedures in traditional cost planning works against the ability of the quantity surveyor to advise the client. Secondly, risk and cost planning limitations are exacerbated by the passive role played by the quantity surveyor in the design development process, and he or she is therefore unlikely to implement risk management strategies since they require a proactive response to ensure project success (Loosemore, 1993; Bowen, 1993; Morrison, 1983).

Against this background, the principal problem researched is:

In construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget, as determined by the professional building cost consultant.

1.3 Hypothesis

The hypothesis of this thesis is that:

The risk management function as exercised by the professional building cost consultant in cost planning and control of building projects is usually ineffective.

1.4 Research objectives

The primary objectives of the thesis are:

- *to identify the current practice of cost planning and control of building projects employed by professional building cost consultant firms in Kenya;*
- *to identify the risk characteristics of construction projects and the risk management techniques employed by professional building cost consultants in the cost planning and control of building projects;*
- *to evaluate the efficiency of traditional cost planning procedures with special reference to adequate identification of their sources, thus enabling a positive response to the adverse risk conditions that create construction cost excesses and cause final construction costs to exceed defined budgets. The evaluation of risk in traditional cost planning and control procedures needs to be improved to meet clients' expectations. Identifying the risk sources and their cost significance would increase the effectiveness of the existing cost planning procedures*
- *to examine the benefits that could be derived from a properly formulated risk management system within the context of the cost planning and control of construction projects;*
- *to develop recommendations for changing cost planning and control procedures, so as to accommodate the risk management function in the cost planning and control of building projects. This should facilitate timely identification of, and response to, potential budget overruns.*

1.5 Research methodology

At commencement of the research it was important to establish the philosophical basis or the paradigm of the research. Two philosophies could be adopted in conducting this research: deductive theory testing and inductive theory building (Creswell, 1994). The deductive approach represents the positivist paradigm and the inductive approach represents the phenomenological paradigm (Easterly – Smith et al., 1991). To establish the nature and extent of risk management in cost planning and control in building projects dictated the use of both paradigms.

1.5.1 Epistemological position taken in the research

Research methodology is the framework for the application of research methods with the epistemological position as the underpinning perspective which raises the possibility that the formulation of the research question and the selection of the methodology as it appears within written account of the research (Silverman, 1985). The epistemology / research philosophy used in this research reflects the basic belief on the objectivity of the researcher in assessing information. In a quantitative approach the researcher remains distant and independent from the respondents and the subjects being researched.

The research methodology chosen take advantage of two paradigms, positivism and phenomenologism. Empirical evidence is collected and analytical generalisation was used on the collected data. The question about the accuracy of the information was important when combining the research methodology and therefore the information had to be triangulated. In quantitative orientation variables are not identified as a priori but in the qualitative orientation variables emerge from the information. Moreover, the method being used to gather information was both positivist and phenomenological and is widely used as the basic approach to qualitative research (see, Yin 1994). Triangulating the information among the different sources was done to improve the accuracy of the results and the conclusions arrived at and the interpretation of the data. The variables to be tested were sourced from the literature and were selected to establish the nature and extent of applications in cost planning and risk management. In the case study interviews, the researcher interacted with the informants who had supplied the answers in the questionnaire survey to observe meaning attached to the practice and actual corroboration of information with the original information from respondents (Creswell, 1994).

The quantitative work is subordinated to the qualitative process in that it is seen to assist quantitative research providing the theoretical framework, validation of data, interpreting statistical relationships and deciphering unclear responses (Fielding and Fielding, 1986).

This view of methods as complimentary brings in the concept of triangulation. Its usage in research design and philosophy usually emphasises combining methods (Fielding and Fielding, 1986) although it applies equally to data sources or accounts of events and even different researchers. What is being applied here is triangulation of different methods to the same subject in explicit relation to each other.

Furthermore, the methodology used was based on grounded theory that was seen by the researcher to occupy a middle ground between positivist positions where facts are discovered yet in being objective the epistemological position recognises the inter-subjective nature of information. This recognition of a level of objectivity facilitates the use of both qualitative and quantitative methods within the overarching methodological framework of grounded theory. The rationale for undertaking a quantitative approach for the study was its adoption and verification by others (Creswell, 1994). The results could yield significant variables that indicated which factors among the selected factors from the literature affect the practice of risk management in cost planning and control of building projects. The study needed explanations as to why the practices of risk management in cost planning and control in building projects was ineffective as offered by the quantity surveyor in Kenya. This required deductive and interpretative reasoning which was the core of this research.

The significant variables in the current practices are chosen before the study begins and remained fixed throughout the study. This helped in developing generalised data that contribute to the theory, that enable one to better predict and explain significant risk indicators. The identified significant risk indicators that emerge provided rich information on current practices leading to patterns and theories to improve on current practices of cost planning and risk management offered by the quantity surveyor in Kenya. In order to accommodate the current practices, develop the theory and change the practices this research dictated interpretative and descriptive research that made minimum use of statistical relationships.

Kenya, where this research was conducted, is a country with a growing building sector that has limited building data and a developing building infrastructure and the objectives of this research have been achieved by adopting the following research methodology:

1. *A literature survey focusing on pertinent subject matter, with an emphasis on risk management and cost planning and control in building projects.*

2. *A combination of postal surveys and case study interviews with professional quantity surveyors, architects, engineers and client firms in Kenya to establish:*

a. the current practice of cost planning and control;

b. the current practice of risk management;

c. whether risk management is integrated into cost planning and control and, if so, the manner in which the risk profile of building risks is communicated to the client.

3. *An analysis of the results of the empirical studies.*

4. *Recommendations developed from the study of cost planning and control procedures for the explicit accommodation of risk.*

5. *Conclusions and recommendations for future research.*

1.6 Limitations

This research represents a detailed investigation extending into the areas of financial management and risk management. The extensive nature of these subjects precludes a comprehensive evaluation of each topic in its entirety, and certain limitations inevitably prevail. The primary focus is limited to financial aspects relating to building projects; specifically, the absence of risk indicators in traditional cost planning and control, together with the management and control of costs to ensure that defined budgets are not exceeded, given the financial risks associated with building projects. Although the fundamental principles and theories relating to risk management, and cost planning and control, with respect to building developments are addressed, the study is confined to their practical application by the building professions and their clients in Kenya.

1.7 Outline of the thesis

This thesis comprises the following ten chapters that are outlined in Figure 1.1

Chapter One is a general introduction to the background of the research.

Chapter Two reviews the literature on research issues associated with risk indicators in building and risk management. It focuses on descriptions of risk indicators and risk management to establish the conceptual framework of the thesis.

Chapter Three is a discursive treatment of cost planning and control, and the financial management of building projects. It describes how other disciplines use risk management in dealing with risk.

Chapter Four discusses risks in the building environment, risk identification, risk drivers and the treatment of potential risk indicators. It explores the research issues that will be raised in the research design described in Chapter Five.

Chapter Five draws together the issues that informed the primary data collection and proposes a research methodology and design, comprising a combination of postal survey questionnaires, case studies and interviews with professional quantity surveying, architectural and engineering firms, as well as client organisations, in Kenya.

Chapter Six documents the analysis of the results of the questionnaire survey and the interpretation of the questionnaire survey data.

Chapter Seven comprises the protocol and justification of the case study interviews. The research method adopted in the case study is intended to give insight into the risk management of building projects within the process of cost planning and control.

Chapter Eight analyses the case study interviews and interprets the resulting data.

Chapter Nine integrates the empirical results from the questionnaire and the case study interviews and discusses how these relate to one another.

Chapter Ten documents the research findings together with the conclusions, and proposes areas of future research.

1.8 Conclusion

This chapter has presented the background of the research and introduced the research hypothesis. Finally, limitations to the research were discussed and the structure of the thesis outlined.

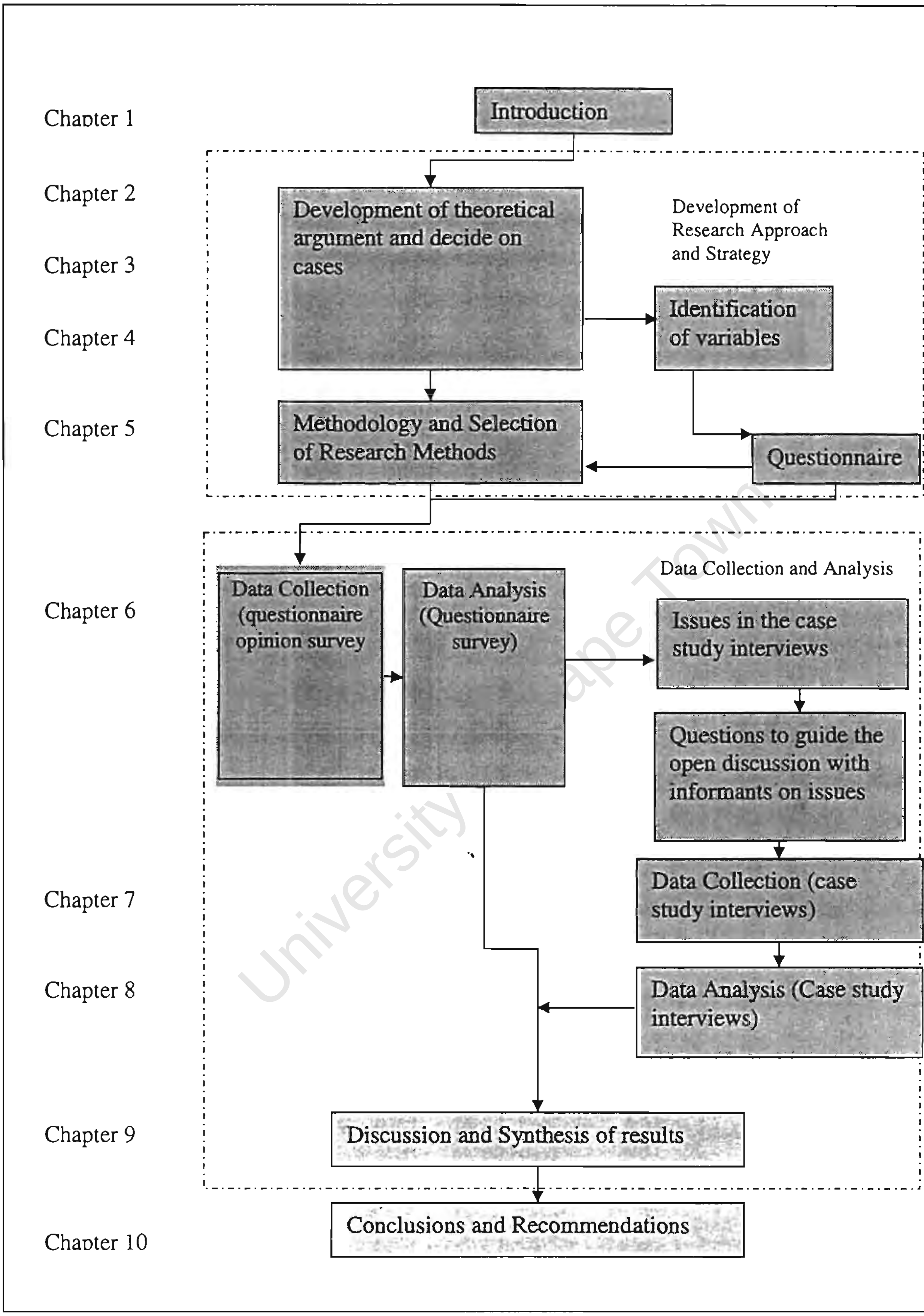

Figure 1.1 Thesis Layout

CHAPTER 2

Risk Indicators and Risk Management

2.1 Introduction

The problem statement in Chapter 1 contends that the Kenyan building clients surveyed in this study are exposed to financial risk as a result of final building costs exceeding the set budget. This chapter discusses the definition and evaluation of financial risk indicators in forecasting building costs and the associated risks.

The chapter sets out relevant literature in risk management to indicate the relationship between financial risk management and the research problem stated in Chapter 1. It discusses research issues regarding the concepts of indicators and risk, as well as risk indicators in building budgets and risk management. Specifically, the chapter attempts to address the questions: *What are risk indicators? and What is risk management*?

2.2 Risks and risk indicators

In Kenya, as in other countries with developing building sectors, there has often been a wide disparity between the originally predicted project budget and the final building cost (Al-Momani, 1996). There is therefore a need to understand and quantify risk in budget prediction and risk management. This section discusses the concept of risk, the most common risks involved in building projects, and, finally, risk indicators.

2.2.1 The concept of risk

Kartam and Kartam (2001) have defined risk as the probability of occurrence of some uncertain, unpredictable and even undesirable event(s) that changes the cost prospects of a project. Hillson (2002), citing the Guide to the Project Management Body of Knowledge (PMBoK), describes risk as an uncertain event or condition that, if it occurs, has a positive or negative effect on a project cost objective. Boothroyd and Emmett (1998) and Bufaied (1987), cited by Kartam and Kartam (2001), describe risk in construction as a consideration in the process of a construction project whose variation results in uncertainty in the final cost. Cooper and Chapman (1987) say that risk is exposure to the possibility of economic or financial loss or gain, physical damage or injury or delay, as a consequence of the uncertainty associated with pursuing a particular course of action. For the purposes of this study, risk may be defined as follows:

Risk is an exposure to financial cost impacts, arising from involvement in the construction process where cost variations result in uncertainty in forecasting building cost.

The concept of risk refers to a probability of potential loss or gain but it may also refer to the cost outcome from unknown and unplanned events, or from financial hazards posed by human, technical or managerial failures (Chapman, 2001). The idea of risk originated in mathematics associated with gambling and it is against this background that risk is often evaluated as a quantitative concept. In building, the concept of risk refers to interference or interruption in a planned activity or in an anticipated outcome.

Various authors have made important basic statements about risk. Hillson (2002) points out that when and if uncertainty occurs, either as a threat or as an opportunity, it can have a range of effects on the achievement of a project's cost objective, from total disaster to unexpected savings on the final cost. Bennett and Ormerod (1984) interpret uncertainty as comprising interference – for example, those external factors affecting a project which disrupt work on a particular task and its variability. Raftery (1994a) maintains that risk and uncertainty characterise situations where the outcome for a particular event or activity is likely to deviate from the estimated value. Dembo and Freeman (1998), cited by Elkington and Smallman (2002), say that to decide whether a risk is worth taking, it is essential to determine its potential cost impact and the likelihood of its actually occurring.

Hillebrandt (1985) uses the terms 'risk' and 'uncertainty' in construction interchangeably, but some authors, such as Flanagan and Stevens (1990) and Byrne and Cadman (1984), differentiate between the two terms. Other authors have suggested various definitions of the two terms but the main argument is that uncertainty arises when the occurrence of an event cannot reasonably be anticipated or its magnitude cannot readily be determined.

The primary result of unanticipated events occurring is financial. According to Frosdick (1997), because giving cost advice involves the unknown, financial errors, omissions and failures are likely to occur. Edwards (2001) and Flanagan and Norman (1993) mention uncertainty associated with estimates of financial outcomes when giving financial advice to a client. White and Fortune (2002) examine the concept of financial risk and the experiences of building-budget prediction obtained from real projects.

Since this research is concerned with the construction industry, the next section examines the concept of risk explicitly in terms of building projects.

2.2.2 Risks in building projects

As has already been mentioned, the concept of risk in building refers to interference or interruption in a planned activity, or in an anticipated outcome, which alters estimated building costs (Hillson, 2002). Liu and Walker (1998) concentrate on unknowns and uncertainty in forecasting building costs in the evaluation of project outcomes.

Edwards (2001) noted that building projects are executed under a flexible management structure and as such are particularly susceptible to cost variations, thereby exposing the client to more financial risks.

Flanagan and Norman (1993) point out that failure to act, omissions or missed opportunities for controlling risk or for preventing something from happening, will certainly impact upon the cost budget of a building project.

2.2.3 Risk indicators

Tah and Carr (2000) point out that risk factors do not themselves directly affect building activities, but they are recognised through risk outcomes that can be termed 'risk indicators' before their occurrence. They distinguish between risks and risk factors by assuming that risks are triggered by factors that can be recognised as 'cause-effect' indicators at an early stage of project development. Their cause-effect model resembles that of Chapman (2001), who maintains that a cost overrun is the effect or outcome, not the risk itself. They say, in addition, that the event causing the risk can usually be controlled if the source is detected in time.

Distinguishing risk indicators is an attempt to identify events or factors that are likely to lead to financially hazardous outcomes. Hillson (2002) says that disastrous occurrences (or unplanned savings) can sometimes be assessed and even controlled through considering risk indicators. Kim and Bajaj (2000) and Mak et al. (1998), show that the concept of risk incorporates technical, human and managerial as well as financial indicators of risks that demand financial responses.

Tucker and Taylor (1990) define an indicator as a quantitative or qualitative measure or activity that enables the assessment of an event. Flanagan and Stevens (1990) identify a risk indicator as a quantifiable element that may be calculated in terms of the probable outcome of a decision. Elkington and Smallman (2002) contend that risks can be explained and understood in terms of relevant risk outcomes. Given that risk management depends on the participant's risk perception, these outcomes can be described as risk indicators. They further interpret risk as follows: risk can either be ignored or taken up as an indicator (or indicators) of risk or as an opportunity for cost variation.

Tah and Carr (2000) define a risk indicator as an abstraction of the lack of predictability of a risk factor which describes situations that can be individually assessed, given only limited information or facts. In this study the term 'risk indicator' will refer to a measure of a piece of information or statistic, referring to qualitative or quantitative measures of the predictability of a project's financial outcome, cost outcome, forecasting, estimating and planning conditions (after Hertz and Thomas, 1984).

Feasibility studies must detect potential threats, and opportunities available, long before any funds are appropriated (Jeffery, 1996); thus demonstrating the need for advance identification of risk indicators that would show potential risk threats. Failure to look for future building problems and opportunities through indicators can lead to ineffective budget cost prediction (Hillson, 2002; Ward, 1999), but once the financial risks that affect building budgets are known, their risk indicators can be determined. Ranasinghe (1998) reported that the insurance industry relies on the effective financial management of risk indicators and uncertainty.

According to Hertz and Thomas (1984), a risk indicator is synonymous with uncertainty, and uncertainty indicates a lack of predictability about a problem structure, outcome, or consequences in a decision or a planning structure. The same situation applies to building processes that are sources of adverse events, especially where risk indicators could be of special significance to building cost prediction. Diekmann (1997) notes that risk indicates the probability that prejudicial incidents will occur during the project development period and this would be a good starting point for risk assessment and risk management process. Even then, risk indicators may trigger a negative or a positive impact on the financial viability of the project (Hillson, 2002). Senior's (1990) work on lump sum contracts supports this view.

Despite the scarcity of information at early project development stage, budgets are required to guide project development. In cases where the future state cannot even be imagined, let alone defined, the professional building cost consultant is unable to predict future risk events accurately (Pender, 2001). Moreover, both the uncertainty of the future and present ignorance of the state of previous projects – including the potential planning information available – are poorly handled by commonly applied probability theory, which can therefore not be relied on to produce effective budget plans (ibid.). Indicators thus become important in situations where there is scarce information.

Even though some important project features may not yet be specified at early stages, a set of risk entities to be used in budget prediction should be constructed, including target risk entity. The selected representative variable, called the risk indicator, would have selected defining features (Samid, 1996) to distinguish it from other risk sets. The definition of the risk indicator will be based on well-defined building events that relate to several risk features for the cost of each risk indicator. For example, some indicators of particular risks may serve as general risk indicators in that they can refer to whole sets of risks – possibly all risks up to a certain point in a project, including risks that have not yet been identified. It is important to recognise the opportunities provided by such general indicators and the value of investing resources in establishing which risk indicators are likely to simplify risk management (Ward, 1999).

Elkington and Smallman (2002) assessed significant risks to determine the acceptability of each in the budget prediction, and maintain that risks may be grouped together and have their impact assessed on the basis of acceptability. Selecting an appropriate risk, based on assessment priority to a risk indicator, improves the information on the particular risk and its management, and risks can then be grouped into priorities that are appropriate to the project. In addition, Chapman and Ward (1997) also considered the concept of assessing and evaluating the risk in groups in a cumulative manner, which meant that any new risk discovered was added to an established group of risks.

Risk similarity or relationships, risk cluster grouping and priority ranking help in managing risks (Kendall, 1980). Likewise, the findings from integrating the broad risk subsets for each project offer the possibility of assessing and managing cost impacts, depending on the type of risk and effects of the risks. The effects he portrays show the combined effect of the risk under study, as well as allowing diagnosis of the implications of the risk to internal and external influences (Chapman and Ward, 1997).

Chapman (2001) maintains that a cost overrun is the effect or outcome, not the risk itself. Risks can have one or more cause, and risks with similar causes, or triggered by the same event, can be placed into one relationship or 'cluster'. The cost effect can thus be considered under a risk cluster represented by one financial risk indicator. In spite of this, the causal factor might not be predicted and its omission might be a cause of a greater cost impact. Risk outcomes may also show a similarity, a relationship or a common risk character.

Macsporran and Tucker (1996) recognise an indicator as some quantitative or qualitative measure in the form of a piece of information or statistic. Specifically, an indicator implies comparison, and in practice it generally contains two or more variables, related by the triggering of an event or by the risk outcome that affects the budget estimate. Moreover, risk management needs quantitative and qualitative measures of risk in order to compare current projects with previous budget performance, or to compare actual budgets with the expected final cost or a particular building cost estimate with a similar cost of a previous building project (ibid.).

In risk management, financial risk indicators will probably be based upon similar past budgets, past history or future goals and building cost objectives. Ultimately, indicators of various types can be developed through existing risk literature, in order to improve the efficacy of budget prediction and risk management. However, forecasting risk in building projects has to accommodate the different interests of the project's participants. There is a need to understand the client's requirements, converting them into costs, including the future user's behaviour and management tendencies under conditions of uncertainty. There is bias in judging client requirements, and bias towards future project needs generates outcomes that affect building activities. According to Atkinson (1998), human error, cost planning conflicts and adverse events in building development can become cost impacts. These become pointers to financial impacts that later manifest themselves as financial risk indicators. Birnie (1993) and Mak (1992) agree on the subjectivity of cost evaluation of a client's risk and that client requirements affect risk identification and budget prediction.

Management failures are risk pointers to unplanned events that will affect estimated building costs, and manifest themselves as financial risks in building development. According to the Royal Society (1991), unknown events (accidents) are pervasive and affect every aspect of human endeavour. This happens for three reasons. Firstly, forecasting errors arising from unknown events is a common problem in building projects (Atkinson 1998). Secondly, risk issues are seldom explicitly quantified. Thirdly, there is an absence of risk indicators in traditional cost planning and control at an early stage.

2.2.4 Summary of concepts of indicators and risks

This section provided a basis for understanding risk and the concept of risk indicators. The possibility of economic or financial loss or gain was introduced as a quantifiable element that may be calculated in terms of the probable outcome of a forecast. Risk factors do not necessarily affect building activities directly but can do so through 'risk drivers' that can be identified as risk indicators. A risk driver is a source or event that triggers the occurrence of a risk. These can be as diverse as a labour strike or an environmental change.

2.3 Risk indicators in building budgets

This section explores a number of risk indicators: risk occurrence, uncertainty, risk magnitude, risk life cycle and risk correlation. It attempts to identify similar risk sources, features and characteristics with a common financial cost outcome, that could be termed risk indicators in building projects.

2.3.1 Risk occurrence as a risk indicator

According to White (1995), risk occurrence will be taken as an indicator of system failure or the possibility of loss, injury, disadvantage or destruction. Although there is little agreement in the building literature on the meaning of risk occurrence, the notion of probability is central to all assessment techniques. Most risks are identified with their outcomes and occurrences as well as with their risk indicators or with pointers that represent the outcomes. The type of risk that a building is exposed to, determines the type of financial risk indicator that can be quantified in a project, but Chapman (2001) and Ward (1999) select significant risks only when dealing with and managing financial risk occurrences and outcomes.

Flanagan and Stevens (1990), in their article on risk analysis in quantity surveying techniques, recognise that the construction industry is exposed to risk and uncertainty. While exposure to risk has been reported in the building literature, for example, Raftery (1994a), and Cooper and Chapman (1987), budget prediction seems to have escaped research attention – this despite the findings of the British study by Akintoye and Fitzgerald (2000) which shows a lack of practical knowledge of the construction process by those responsible for estimating. As long as future building costs cannot be predicted with certainty, there will be risks arising from building development (Raftery, 1994a).

Raftery (1994a) also notes that property development cannot occur without risk. Cooper and Chapman (1987) emphasise the need for dealing with risks recognised as likely to impact negatively on building funds. They refer to the initiation and actualisation of building processes that focus on the forecasting of building costs and estimates.

The published construction literature has shown that unknowns will always exist in building development, but determining their indicators is likely to enhance financial planning and minimise the probable costs. Elkington and Smallman (2002) and Ward (1999) argue that there is a need to evaluate the level of risk indicators to determine their significance and cost importance to the final building cost.

Tah and Carr (2000) present qualitative relationships between risk sources and their consequences for project risk indicators. Understanding these relationships is essential to budget prediction and an understanding of risk outcomes. Their study considers fuzzy techniques of risk assessment although they do not attempt to quantify risk indicators. On the other hand Frosdick (1997) argues that claims of scientific objectivity in probability and the uncertainty of occurrences cannot be sustained. He says that techniques in themselves are insufficient without knowing what occurrences they refer to, and perhaps their risk indicators. According to him, risk indicators are the forerunners of risk and refer to risk outcomes before they occur. Kangari and Riggs (1989) support the qualitative assessment of risk where risk indicators represent the qualitative or linguistic terms of risk occurrences and outcomes. The same assessment needs to be applied to occurrences and magnitudes of impacts in situations where quantitative or detailed information is not available.

2.3.2 Uncertainty as a risk indicator

Cost uncertainty is a state of incomplete knowledge about a financial variable (Edwards and Bowen, 1999). Bennett and Ormerod (1984) believed that uncertainty is a collection of factors contributing to a budgeting problem, with a variability and interference component in budget performance as well as in the budgeting task. In contrast, Pender (2001) has defined uncertainty as the variability of future cost and financial outcomes where probability distributions cannot be constructed. In the context of this study, uncertainty can be defined as a lack of financial certainty in budget prediction, thus implying inadequate or incomplete knowledge about cost indicators in a particular building event or outcome.

Despite a lack of future knowledge about a particular event or outcome, Fellows and Langford (1980), using Bayes' theorem, attempt to explain decision theory in contracts and tendering – which ultimately affects building costs. Pender (2001) disagrees with their findings that once there is an increase in project knowledge, information and the statistical data regarding uncertain events, the areas of uncertainty may be progressively transferred to areas of risk. They say that a subjective quantification of risk indicators would lead the quantity surveyor to assign a probability to uncertainty and risk occurrence. The use of statistics alone does not remove project uncertainty, but probability assignment of uncertain occurrences can enhance cost forecasting through the determination of known risk indicators (Birnie, 1993; Mak, 1992). Kangari and Riggs (1989) have a similar approach to risk assessment by using the qualitative assignment of risk indicators.

Flanagan and Norman (1993), in their publication on risk management and construction, state that to remove uncertainty in projects, it needs to be quantified in a structured way. They conclude that once uncertainty has been detected it becomes a risk problem, showing that even the risk indicators that accompany those uncertain events and outcomes can be determined by statistical methods. Their view supports that of Flanagan and Stevens (1990) as well as other publications addressing the elimination of uncertainty at later stages of a project. Their quantitative assessment of risk indicators refers to the presence of uncertainty when too little information is available – unlike Kangari and Riggs' (1989) consideration of qualitative information to evaluate uncertainty.

At an early stage of the project the risks may not be adequately evaluated. Loosemore (1993) performed a study on designing reactive organisations to deal with uncertainty. He concluded that the incidence of risk events depends upon environmental certainty; that is, a project's success depends on the effective monitoring of building events and their risk indicators. His focus was, however, on designing reactive organisations rather than proactive ones which would have prioritised building risk in order to determine significant risk indicators. On the other hand Raftery (1994a) and Schumacher (1996) both found that reactive systems, like their risk indicators, can be used to predict other future events.

2.3.3 Risk magnitude as a risk indicator

Mak (1992), in a thesis on construction risk, refers to risk management as "a study of subjective judgements". His research, based on a questionnaire survey, reported that probability is a way of measuring uncertainty and that it can be assessed objectively even though the magnitude of the risk might not be clearly evident. Although Mak had difficulty in retrieving data from completed projects, he concluded that the relationship between the probability of an event occurring and the range of its variability is an important consideration in the building budget. In addition, the size of potential loss, rather than the degree of risk magnitude, may establish a distinguishing attribute of the building cost and the budget response.

Accomplished management teams should supervise projects but the magnitude of factors that are not considered can cause substantial cost overruns (Diekmann, 1997). At the same time, while the magnitude of risk exposure is fundamental to financial forecasting, the potential problems are not always obvious. Thus potential cost overrun might be caused by the unknown magnitude of each risk event, so that there is a need to determine not only the particular type of risk, but also its magnitude as a future risk indicator. Mak et al. (1998) in considering risk magnitude, and Loosemore (1993) support Diekmann's view on qualifying of risk magnitude as a indicator of future risk.

Notwithstanding risk magnitude quantification problems, Burchett and Tummala (1998) conducted a study of capital investment decisions in transmission line projects. They were interested in selecting successful projects but, as pointed out by Pender (2001), they neglected the inclusion of unsuccessful projects in their study. Their emphasis on risk entity differs from that of Elkington and Smallman (2002) as they say that the magnitude and direction of cost impact may not be predictable, known or controllable. Other authors, for example Raftery (1994a) and Flanagan and Norman (1993), have reported that crisis, conflict, hostility and threat generate risk indicators of different magnitudes.

2.3.4 Risk life cycle as a risk indicator

Papageorge (1988) divided the progressive risk life cycle into three distinct stages: the inactive stage, the active stage and the termination stage. He suggested that the same cycles were suitable tools for quantifying risk indicators, and concluded that this distinction of life cycle stages helps the building consultant to formulate appropriate response actions in future financial impacts. His findings on future response actions parallel those of Zelouf (1995) as he says that the active stage identifies the conversion of a potential financial impact into reality.

Unlike Papageorge (1988), Wirth (1995) is of a similar opinion to Zelouf, recognising that project administrators are concerned with budget control but have more effective cost control (risk indicators) when applying cost and project life cycle concepts to theoretical cost prediction. Zelouf (1995) discovered that the advantage of using cost prediction with life cycle indictors was a more effective cost control tool which allows short-term shifts of resource allocation and prevents haphazard budget overruns.

Medley (1996), in an article on the life cycle perspective, concludes that management should encourage a participative approach in which managing cost would be enhanced by team consultation and interaction. His contention is that the risk life cycle cost provides a foundation for a proactive approach to managing financial risks before they occur. Even then, his approach to the risk life cycle perspective is based on cost contribution to budget cost and the working knowledge of those factors that apply to a specific project. He categorises these risks as external factors which include the political system, the economy, social systems or practices, the legal system, and the technological and financial system, while internal factors include location, management policies and types of enterprises. His interpretation of the importance of the life cycle approach to costs contrasts with Zelouf's (1995), which emphasises building cost budgets based on prevailing market conditions but not on risk indicators.

Despite his concern with the risk life cycle, Jaafari's work (2001) on the project management of risk, uncertainties and opportunities is concerned with strategy-based risk determination. As the building project is a long-term business entity, Jaafari uses life cycle objective functions as the main driver of risk assessment and evaluation. His research concludes that an evaluation of risk indicators should be based not only on delivering projects but be within the budget. Similarly, he says that shifting life cycle risk approaches in the risk forecasting of building costs would help in pointing out risk indicators (problems) that manifest themselves later as financial risks and uncertainties.

Ultimately, a potential risk indicator and feature, such as the risk life cycle, can play a vital role in an individual's judgement or choice of action when it comes to risk indicators. According to Pedwell et al. (1998), not only is project information scarce at the early stages of project development, but there is also a failure to recognise risk interaction between life cycle strategy and capital cost, which places the venture at a competitive disadvantage. They maintain, however, that many project risks and uncertainties are particularly high during the pre-implementation stage when the client's influence on building costs is the greatest, and this is the time at which life cycle risk management strategy should be laid down, and risk indicators identified.

2.3.5 Risk correlation as a risk indicator

Beeston (1986) suggests that risk drivers are dependent on each other in situations where one risk may trigger a series of risks. He maintains that understanding risk correlation is essential when considering a combining of risks in estimating. In this study he attempted to determine the strengths of all possible pairs of dependencies (correlations) but found this to be difficult during risk assessment. Mak (1992) and Birnie (1992), however, question the (quantitative) use of probability theory on its own to solve estimation problems. Researchers, for example Lorance and Wendling

(2001) and Dysert (2001), combine risks in the cost budget, using conventional estimating techniques, though even then it required the application of appropriate software. Their approach was in contrast to that of other researchers, for example Frosdick (1997), who argued against over-reliance on software for risk assessment. Pender (2001) and Frosdick (1997) argue that more technological applications, for example computer programs, do not improve the accuracy of cost budgets. Dysert's interpretation (2001) is in contrast to Frosdick's argument (1997) that not only was computer software merely a tool, but that it cannot represent human judgement and intuitive feelings while determining significant risk indicators in a project.

It should be noted that earlier works, such as those of Mak (1992) and Birnie (1992), depended to a large extent on software which has since been superseded.

Raftery (1994a) argues that the distinct characteristics displayed by independent and linked risks require the adoption of different approaches to determine risk indicators. While these relationships are often difficult to quantify or even determine, failure to recognise their existence may result in seriously misleading indications of risk exposure. For example, Spooner (1974), as cited by Diekmann et al. (1988), describes the consequences of ignoring budgeting complexities as being due to correlation between variables in building cost budgets that are assumed to be similar. He found that as much as 55 per cent of the variance in cost budgets could be attributable to correlation between variables. In other words, if a cost budget technique cannot deal with the complexity due to correlation, then the risk assessment would be understated (Diekmann et al., 1988). Spooner (1974), recommends decomposition techniques to overcome this problem. Creese and Li (1995) supported similar ideas for determining risk correlation in advance, focusing on the use of neural networks to establish precise risk relationships, in spite of the fact that – at that stage – the correlation of risk indicators was difficult to detect at the early stages.

Notwithstanding the difficulty in establishing risk correlation, Ranasinghe (2000) studied event impact and the effects of induced correlation on the estimation of project costs, but did not arrive at a better risk assessment option.

Despite using historical cost data obtained from leading quantity-surveying firms in Sri Lanka, he still showed a dependency of certain risks on each other. Such risks are by nature interrelated, that is, if one occurs, the others are likely to follow. Working in the insurance industry, Ranasinghe (ibid.) concludes that risks are to a large extent either totally interdependent or perhaps all arise from the same underlying cause. The determination of risk indicators is essential to guide the quantification and assessment process. The findings of Wall (1996) and Schumacher (1996) concurred with Ranasinghe's approach (2000) of advance quantification and assessment of risk indicators.

2.3.6 Summary of risk indicators involved in building budgets

In conclusion, uncertainty can be understood as an interference with, or variability in, a forecast or a financial impact situation. Thus risk and uncertainty are indicated through situations where the outcome of a particular event or activity is likely to deviate from the estimated or forecast value.

Risk indicators are abstractions of risk occurrences. A risk indicator has three elements, namely a cost impact, a magnitude and a life cycle. The distinct characteristics displayed by independent and linked risk indicators require the adoption of different approaches to their quantification.

2.4 Risk management

Following on the discussion of risk indicators, it is necessary to turn to risk management in order to understand its implications for the forecasting and quantification of risk issues relating to building projects. This applies particularly at the early building stages, in order to improve project planning.

The purpose of this section is thus to examine the theoretical base of risk management and its relationship to the quantification process. This is essential for future chapters, as the effective quantification of risk indicators is often a key to effective budget prediction and forecasting.

2.4.1 Risk management in building projects

Risk management in building is the systematic application of financial planning, monitoring and controlling of risks in building projects, based on information produced by risk analysis (Frosdick, 1997). Edwards and Bowen (1999) view risk management as the task of gathering and interpreting information to influence response action, implying a deliberate attempt to deal with contractual, environmental, safety and financial risk in building projects. Flanagan and Norman (1993) emphasize the separation of risk analysis from risk management, saying that risk management in building cost forecasting needs to be strategised and itemised for a clear understanding of risk causes, cost outcomes and risk drivers. Risks are multi-dimensional, and their cost impact depends on how they combine and interact (Miller and Lessard, 2001). In the context of this study, risk management can thus be defined as a deliberate process of identifying, quantifying and assessing choices between alternatives and is a primarily decision-making activity (ibid.). The Royal Society study group (1991), and other researchers in risk management on advance selection of significant risks, had already put forward this view. For example, Flanagan and Norman (1993) maintain that the making of financial commitments involves risks and risk indicators; subsequent assessment, estimation and risk quantification are thus all part of financial management planning and control activity. Yet a lack of motivation in the management structure of building organisations causes a lack of effective communication that is reflected by the uncooperative and differentiated nature of these construction organisations (Loosemore, 1993). Edwards (2001) cites more problems, which might be assessed as risks, generated by temporary management structures creating communication barriers in risk management.

Mok et al. (1997) used a questionnaire survey in a study on the practices, barriers and benefits of the risk management process in building services cost estimation. They found that traditional cost estimates are prepared by a deterministic single-figure approach that is often inadequately detailed. They also found that cost planning practice is not adequately proactive, thus affecting cost prediction and risk management. For example, the majority of building service engineers still adopted traditional deterministic methods. There was extensive use of traditional estimating methods in the building industry, as was found not only by Akintoye and Fitzgerald (2000) but also by Edwards (2001). Developments in cost estimating methods have not shifted the preferences of cost practitioners for traditional estimating methods (Bowen, 1993). Akintoye (2000) agreed with Songer et al. (1997) and Mok et al. (1997), on the ineffectiveness of deterministic estimating methods in traditional cost planning and control procedures in the absence of risk indicators.

Kartam and Kartam (2001) used a questionnaire survey in a multiple-choice format, to explore risk significance with some of the largest Kuwaiti contractors. The questionnaire was followed by guided interviews. Kartam and Kartam concluded that contractors show more willingness to accept risks that are contractual and legal-related than other types of risk. They also found that contractors had different perspectives on risk from those held by the professions and clients. This means that budget prediction based on the contractors' cost would be biased towards certain types of risks in building projects.

In Kartam and Kartam's study (2001), a total of 61 large contractors were surveyed, with a response rate of 51 per cent. Their study lists the techniques for managing and controlling risk used by large Kuwaiti contractors, showing that conventional methods were used in assessing building risk. The contractors' use of conventional methods was modest, with the exception of the use of subjective judgement and practical experience. Kartam and Kartam also maintain that, apart from any financial risk that the contractor is likely to suffer, the most significant risks are financial failure, delayed payment, input availability, effects of third party, defective design, competence, and quantity and quality of work. The way to reduce the impact of these factors is by determining risk indicators at an early stage. The focus of the studies of Mak et al. (1998) and Kartam and Kartam (2001) was on contractual risk reduction, but little research attention by these and others has been directed towards building risk management from the client's point of view.

Building risk literature, for example, Kartam and Kartam (2001), Ward (1999), Ranasinghe (1998) and Edwards (1995) advocates a fairly standard approach to building project risk management. This comprises the determination of indicators for project risks; the analytical study of those risk indicators; the exploration of alternative risk responses, and the advocacy and adoption of a specific response. This approach considers the establishment of the client's financial risk profile, as well as the effect of inflation on set financial commitments (building budget), as essential in risk management. The standard (traditional) approach prompted Dawood (1998) to consider risk analysis and planning for the client's risk profile, specifically for financial risk failures in building projects. Likewise Kangari (1991), as cited by Edwards and Bowen (1998), notes that bankruptcy of American construction companies was most frequently attributable to economic and financial factors, noting inflation, interest rates and inadequate capital noted as critical risks. Songer et al. (1997) hold similar views on enhancing project financing through selected significant risk indicators.

Risk management for building projects implies an attempt to set goals and objectives which will influence risk decision-making, and monitor and control risk responses. However, attempts to motivate participants in setting achievable cost goals and cost objectives is lacking in the building budget environment (Drury, 1992). Participants should help shape the project budget so that they are not only committed to it but 'own' it through its creation (ibid.). Brockington (1996) supported team communication approaches particularly in regard to financial risk and their indicators. Communication should help in determining project risk indicators, particularly where there is a lack of quality project information and data. This should flow into the operational management of the completed building.

2.4.2 Risk management planning, control and monitoring

Risk planning methods should be utilised to control resources and costs in a project, and to draw attention to potential problem areas. Unlike Pender (2001) and Baccarini and Archer (2001), Miller and Lessard (2001) maintain that risk management is concerned with the application of theories of planning and controlling risk. The aim of planning is to work out the particular risk requirements and decide on a strategy for identifying risks that could expose the client to cost variations (Chapman, 2001). Management should analyse and prioritise risks, to determine which risk events warrant a response, as there is usually insufficient time or resources to address them all at once. When the roles of planning and management are separated, more research attention can be directed towards risk clusters, group risks, priorities and broad risk entities (Ward, 1999; Samid, 1996) thus simplifying risk management (Kendall, 1980).

Planning methods should be utilised to communicate objectives and identify a sequence of activities when managing risk on construction projects. The owner should define the project's cost objectives and needs, and the professional building cost consultant should identify areas of conflict, constraints and risks associated with the cost objectives, and identify risk indicators, forming the basis of risk evaluation for incorporation into the cost plan (Smith, 1999).

Perry (1986) claimed that it is vital to distinguish between categories of risk (risk profile) and their potential effects, in order to instigate the monitoring and formal aspect of building risk management. Different types of procedures are applied in traditional cost planning and control, yet there is an absence of risk indicators to guide risk management in cost planning and control of building projects.

Hillson (2002) concentrates on positive approaches to project objectives, where risk is seen not only as a danger but also as an opportunity for the risk manager to militate against adverse events. Project objectives must be clearly stated and understood in the initial phase of the risk process, to focus risk assessment on the specific requirements of the particular project. Hillson (2002) supported Pender's (2001) argument that risk management planning forms an integral part of project management, and risk management alone is insufficient in budget prediction.

Budget planning merely defines the processes to be followed; it does not develop appropriate, achievable and affordable actions against risk occurrences, including its implementation and the monitoring of its effectiveness. Exposure to both adverse events and to opportunities should be assessed, evaluated and managed proactively by the professional building cost consultant (Mak, 1992). The proactive approach deals systematically with incomplete knowledge that is complicated by the temporal dimension of risk. A misunderstanding of risk through the traditional approach affects the budgeted cost and the estimator ends up with a large, undefined risk assessment problem (Pender, 2001). In developing a risk management plan it is vital to distinguish between different categories of risk and to instigate fully the monitoring of the risk. Jaafari (2001) supports the introduction of proactive identification of risk to reduce project uncertainty through risk management and effective budget prediction with risk indicators.

2.4.3 Strategies to manage risk

Miller and Lessard (2001) used historical data to conduct a study on understanding and managing risks in large engineering projects. They found that suitable projects are not necessarily selected with risk resolution in mind. They concluded that there was need for a front-end process to cope with risks that is consistent with the project framework. The risk manager should create options for subsequent risk management choices in order to increase the value of the project. Management strategies can aid in the control of risks that become apparent soon after project inception, and in the quantifying of risk indicators. Their approach differs from that of Flanagan and Norman (1993) in its emphasis on classifying risk into categories. Other researchers approach risk management as one process, for example, in the form of a lump sum, covering all building risks (e.g. Mak et al., 1998). Miller and Lessard (2001) focus on risk management resolution as a means of identifying future risk indicators, and on managing anticipated risks as they occur. The findings in South Korea by Kim and Bajaj (2000) recommend the adoption of formal, direct risk management of anticipated risk indicators, even if information is not adequately detailed.

Floricel and Miller (2001) conducted three case studies on strategising for anticipated risks and turbulence in large-scale engineering projects. They found that there are limits to the efficacy of traditional risk management approaches to building projects at the early stages. In addition, strategic risk planning and budget prediction is not sufficient to cope with uncertainty and turbulence, so some institutional management or organisational strategies complement management planning by means of risk indicators. They concluded that some events are totally or partially unexpected, so sooner or later in the lifecycle of all projects, managers come upon new risks. There also appears to be a need for determining risk indicators as early as possible. The findings of Miller and Lessard (2001) supported a similar approach to advance identification of risks where there is a lack of prior risk management, as illustrated in Figure 2.1.

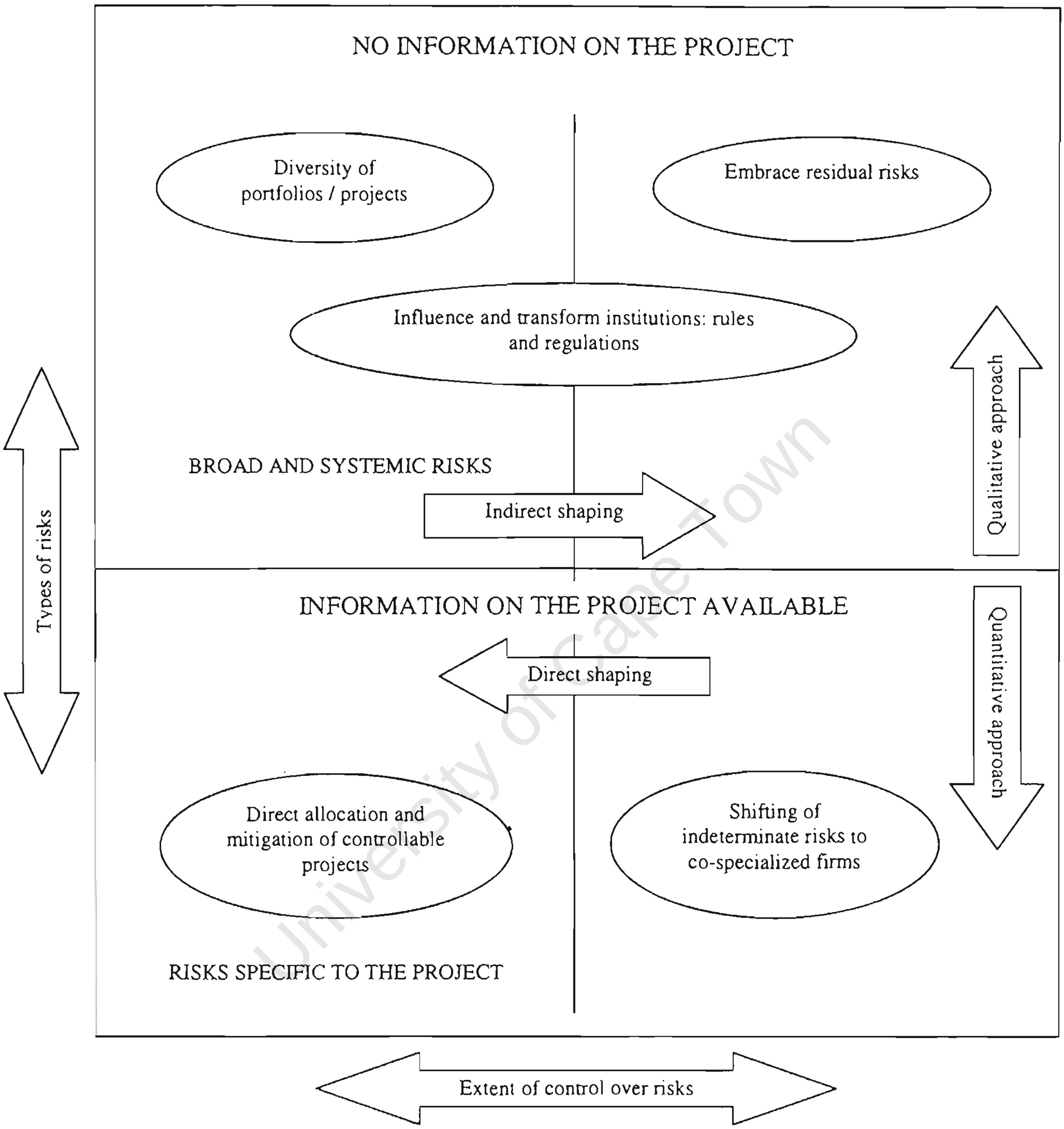

Figure 2.1 Management strategies for coping with risk (after Miller and Lessard, 2001)

Figure 2.1 depicts, along two axes, the extent to which risks are controllable and the degree to which they are specific to a project. The illustration shows that project risk management can be viewed as a complex adaptive system, facing specific and controllable (endogenous) risks as well as risks that are specific but outside the control of parties and cannot always be anticipated in advance or communicated to the estimator (exogenous surprises). There is always some background information which is not clearly revealed by the project design team – such as the background shown Figure 2.1.

In this section, examining risk and risk management has been applied to the building process. This body of knowledge will be developed in later chapters. It is connected to cost planning and control through the predicting of and planning for future costs, since the calculations associated with both disciplines have a strong element of uncertainty.

2.4.4 Summary of risk management

Risk management has been described as a systematic attempt to deal with risk and risk indicators by assessing cost impact, measurement and economic control. For risk management to succeed requires strategies that influence and transform risk indicators. Risk identification and cost planning enhance and facilitate risk management. Institutional management and/or organisational strategies could complement risk planning and management through the shaping of risk indicators.

The section also discussed the fact that there are limits to the validity of traditional cost planning and management approaches.

2.5 Conclusion

This chapter discussed the concept of risk knowledge as related to risk indicators. It explored risk management knowledge and management approaches to risk indicators. It particular it dealt with the limitations created by practitioners depending only on their own experience.

The link between risk and risk indicators was also considered. It was concluded that risk factors do not affect building activities directly but do so through risk drivers that can be termed risk indicators.

Risk incorporates managerial as well as financial factors that may determine the various types of risk indicators that could be selected to represent risk outcomes at the early project stages.

A risk indicator points to a possibility of economic or financial deviation from the estimate or forecast value and is a quantifiable component that may be measured in qualitative terms of probable outcome for the client's financial and cost advice.

Risk management is a systematic way of dealing with risk, determining risk indicators, their quantification and economic control. The quantification of risk indicators involves information and knowledge, which is not always available at the early project stages. Traditional estimating methods are not successful in quantifying risk indicators and there is a need for a better understanding of building risk.

This chapter provided the necessary basis for the discussion of risk indicators relating to risk management in cost planning and control of building project that follows in Chapter 3.

CHAPTER 3

Cost Planning, Management and Financial Risk Indicators

3.1 Introduction

The previous chapter discussed the definitions of risk, risk indictors and risk management, as well as risk issues associated with cost planning and control. Although risk issues are associated with cost estimates, they are seldom explicitly quantified when forecasting building costs. This chapter focuses on disciplines related to risk management and explores how other disciplines deal with risk indicators, while addressing the theoretical base of cost planning and control from which the building cost budget originates.

The chapter is organised into five sections:

- cost planning and control
- approaches to financial management
- approaches to the quantification
- assessment of financial risk
- risk indicators in cost planning and control and conclusions.

Structured this way, the chapter seeks to addresses the question:

What are the financial risk indictors?

3.2 Cost planning and control

Financial risk in budget prediction indicates the need for effective cost budgets that incorporate risk cost impacts at the inception of a project. An effective cost planning procedure is expected to result in a financial management process whereby the cost of the building project remains within the agreed budget of the client. In addition, risk management can be shown to be directly related to an effective budget, through cost planning and cost control in the early stages of a project. This section explores cost planning and control knowledge as it relates to risk management, thereby justifying the following discussion on cost planning and control as a means of providing effective financial advice on budgets to building clients.

3.2.1 What is cost planning and control?

It is the express and implied professional duty of a professional building cost consultant to care for his or her clients (Flanagan and Stevens, 1990) and it is therefore incumbent on the consultant to ensure that sound advice is offered with respect to budgeting for the anticipated building costs. An ineffective cost planning process can be the source of financial misfortune for construction clients. The findings of Hodgetts (1987) concur with those of Flanagan and Stevens (1990) on the need to improve budget advice by incorporating risk impacts into cost plans.

An effective cost planning can be defined as *the process in which the client has confidence in the building estimate given for the proposed project.* The client should not be subjected to unforeseen cost impacts.

In the quantity surveying profession, the method employed to provide financial advice with respect to construction projects in the property development process is commonly known as the 'cost planning and control' of buildings. According to Bowen (1993), this operation represents a primary function in a range of professional services offered by the professional quantity surveyor, as depicted in Figure 3.1 below. Certainly some of these services are cost planning and risk management functions. The interrelationships of the cost planning and risk management functions are represented here, showing the connections and dependencies on the availability of information regarding the future project.

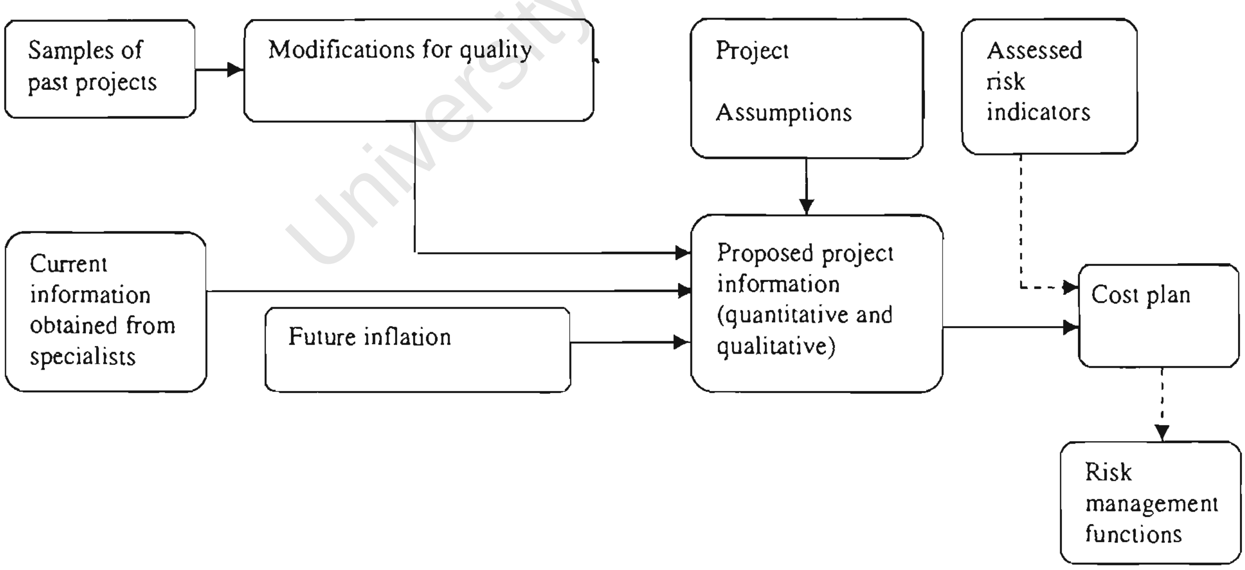

Figure 3.1 Outline of the cost planning process at an early project stage [1]

[1] Adapted from Flanagan and Norman, 1993

Figure 3.1 shows how conventional budgeting techniques need to incorporate the assessment of all likely risks into the building cost budget and cost plan. It also illustrates how cost plans (building budget) accommodate risk impacts during cost planning in order to account for likely risks that might manifest themselves during the course of project development through risk indicators.

In addition, Akintoye and Fitzgerald (2000) concludes that, although the current practice of cost planning and control substantially retained the original conceptual framework, the stated objectives of controlling costs before adverse events occur had not been fully achieved. He cites one of the primary causes of technique failure to be the casting of the quantity surveyor in a totally passive role, only responding to initiatives taken by the architect and/or the design team. Edwards (2001) found similar evidence in a study of South African quantity surveyors who were appointed at the design concept stage.

In contrast to Morrison (1983), Bowen (1993) used a questionnaire survey to examine the techniques of professional quantity surveyors in South Africa in the treatment of uncertainty during the project cost planning process. Bowen maintains that cost planning and control comprise two distinct but interrelated phases. The cost planning phase is the initial stage that relates to estimating the total building cost and identifying those amounts applicable to the respective elements that make up the total building cost. The cost control phase follows the cost plan and refers to the control of the defined costs during the design and construction process. The findings of a British study by Akintoye and Fitzgerald (2000) concur with Bowen (1993) on the idea of lack of effective estimating knowledge at early project stages by those responsible for the estimating functions.

On the well-documented subject of cost planning and control, and more specifically regarding the accuracy of building cost estimates, there appears to be general agreement on the efficacy and limitations of these methods of arriving at a well-formulated building budget within defined cost limits. Researchers, for example Akintoye and Fitzgerald (2000), Songer et al. (1997) and Mok et al. (1997), express similar opinions on the efficacy and limitations of traditional cost planning and control procedures; that is, they state that traditional methods of building cost analysis are inadequate in formulating building budget and risk allowances.

There is a high potential for budget variability in building cost forecasts. In spite of this, risk impacts on future building projects must be assessed for incorporation into the client's cost budget. Since cost planning and control represent a financial assessment of the building construction process where uncertainty is prevalent, a primary consideration must relate to the possibility that adverse events will occur in the development process and so introduce unforeseen expenditure that may cause predetermined budget forecasts to be exceeded. However, risk issues associated with cost estimates are seldom explicitly quantified when forecasting building costs. For instance, a single amount with no suggestion of possible variability falsely implies the typical generation of building cost estimates as absolute accuracy (Bowen, 1993; Miles 1980).

3.2.2 Cost planning

Cost planning starts with the summation of the cost targets set against each element (Drury, 1992). These cost targets establish the budget cost that should not exceed the set building funds. Cost checks are then made throughout the design stage to ensure compliance with the cost plan and the various cost targets. The final cost check is made once the building details are completed. Dysert (2001) agrees with Flanagan and Stevens (1990) about ensuring that cost plans are realisable and do not exceed the set budget.

Potential impacts of risk costs cannot be eliminated from budget prediction and thus risk impacts should be considered for incorporation into the final building cost even before building details are completed. According to Lorance and Wendling (2001), a budget estimate is a quantified value presenting the monetary resources required to achieve a cost objective. At the same time, however, the physical structure of the building is represented in the drawing specifications without consideration of the cost. This absence of cost indicators affects cost plans and the set budget. The most obvious signs of lack of cost indicators are the limitations on details and on drawings. Dysert (2001) found similar evidence in early conceptual estimates developed for the Eastman Kodak Company that lacked risk and cost guidelines.

Hegazy and Moselhi (1995) used a questionnaire to survey elements of cost plans for general contractors in Canada and the United States. This was designed to elicit current practices with respect to the cost elements used and to identify the type of cost plans used by contractors, in order to investigate areas of potential improvement in the cost planning process. They found that construction cost planning was very largely an experience-based process. Lack of generally-accepted cost planning guidelines, the limited exchange of information, the complex nature of the cost planning task, dependence on multiple qualitative factors that are difficult to assess, and the highly fragmented nature of the building industry were all found by Hegazy and Moselhi (1995) to be culprits in effective budget prediction.

There are certain problems in achieving effective budget prediction. Firstly, according to Hegazy and Moselhi (1995), direct costs and project cost plans are based on detailed costs. Bowen (1993) claims that it is wasteful to finalise detailed measurement and costing in advance, as projects are likely to change before their completion. In contrast to other approaches to cost planning, intuition/experience/judgement were considered suitable due to the high level of uncertainty involved and the lack of adequate cost-budget support tools used in cost calculations (Hegazy and Moselhi, 1995).

The secondly prediction problem is that cost planning needs appropriate and accurate cost data to function effectively. Hegazy and Moselhi (1995) maintain that more effective decision-support tools should be developed for cost planning. This reflects the need for an effective cost advice technique that supports the development of quantification tools to aid the assessment of financial risk indicators. Munns and Al-Haimus (2000), while recommending refining the cost planning techniques and tools, agree with Hegazy and Moselhi (1995) on the need to find a more effective cost and risk-planning tool. However, they do not offer a possibility of developing a formulation for budget prediction.

Using historical data from ten large general contractors in the Sydney region of Australia, Uher (1996) undertook research on a probabilistic cost-planning model, and found that probabilistic budget plans introduce the concept of risk management into cost planning, and guide the estimator towards developing the most effective cost estimate at an acceptable level of risk (Uher, 1996). Even then, pricing or costing involves the retrieval of cost data combined with an intuitive process based on experience and judgement. Uher's research also established that probabilistic budget plans introduce the concept of risk indicators into budget planning, to guide the estimator towards developing the most effective cost plan at an acceptable level of risk. The research was concerned with large-scale contractors who came into the project after the design had been significantly developed. The study did not consider the early-stage financial risk indicators when responding to potentially significant construction risks. Uppal (2001) agreed with Uher (1996) that effective cost planning incorporating the impact of risk on budget preparation was rare in the construction literature, thus explaining the general use of traditional cost models in budget prediction.

When calculating probable price rates and forecasting the likely cost, one is likely to use past experience (Diekmann, 1997). This view is supported by other researchers such as Isidore and Back (2001) and Munns and Al-Halmus (2000) who hold that improved methods, for example, neural cost models, range estimating and parametric estimating, produce reliable forecasts of building cost, thereby enabling better cost planning of building projects. Akintoye and Fitzgerald (2000) and Kim and Bajaj (2000) report, however, that cost planning methods and tools that consider risks and variability in cost planning and control have not been adopted extensively by practitioners.

Although conventional cost planning techniques are deemed by Pender (2001) to depend on probability theory and the mathematical analysis involved, they do not aid accurate cost prediction or estimating applications. The determination of risk indicators is essential for effective cost estimation and budget planning and application at an early project development stages (Lorance and Wendling, 2001). Moreover, there is a general lack of familiarity with risk management concepts of risk indicators that affect the application of conventional techniques when forecasting building costs (Kim and Bajaj, 2000). Diekmann (1997) found similar evidence on environmental projects that were likely to run over budget and behind schedule. In much of the published literature on cost planning (e.g. Hegazy and Moselhi, 1995; Morrison, 1983) there are no findings that could be generalised to facilitate the formulation of effective budget prediction and cost planning.

3.2.3 Cost control

The literature on control of building costs with its detailed treatment of procedures is well presented in publications, for example, Law (1997), Flanagan and Tate (1991) and HMSO (1968). All of these approach cost control from a fixed single budget figure. Recent research has paid more attention to the modelling of building costs (Dysert, 2001; Munns and Al-Halmus, 2000; Zhan, 1998) that facilitate a flexible approach to financial control. Dysert (2001) prefers the parametric model, and Zhan (1998) recommends basic guidelines for efficient project cost control. Zhan's proposal concerns a closed-loop control system that is proactive and focuses on early stage cost control. However, risk indicators in a cost control system need to be exposed and quantified for the project to be successful in terms of cost control.

Once planning has taken place, it is necessary to control what had been forecast and planned (Correia et al., 2000). The literature, for example Uppal (2001) and Hodgetts (1987), describes cost control as a means of formulating guidelines or cost targets that should not be exceeded. Publications such as PMI (1996) and the RIBA Plan of Work (1980) emphasise procedures that give cost control to the building client. Jurkiewcz (1995) concentrates on building budget improvement by dual entry accounting, but none of the researchers attempt to control risk impacts by quantification of the risk indicators that affect building budgets or forecasts. The absence of risk indicators in these methods affects their efficacy, a view supported by Morrison's (1983) research findings. There is a need to change the approach to cost planning and control and incorporate risk allowances that cover all anticipated cost impacts.

Egbu et al. (1998) used a case study approach for their survey of planning and control processes and techniques for refurbishment management in the construction and shipping industries. They used 36 semi-structured interviews with key functionaries, and 49 completed postal questionnaires. They found that cost control accuracy, and effectiveness of cost plans in risks and uncertainty management, are affected by the complexity of the works, past experience of the organisation and the organisation's attitude towards cost control *per se*. The study concluded that monitoring and control involves risks and uncertainty and should be improved by the quality and timing of the relevant information, as this would help to improve cost monitoring and hence the effectiveness of cost controls procedures.

Egbu et al. (1998) also concluded that the lack of control indicators arises from a lack of information and poor timing in communication that cause financial risks in building development – unlike the shipbuilding industries where there is prior knowledge and detailed communication before work commences. Quantification, communication and control of the exposed risk indicators would improve the cost control system. However this study was on ship refurbishment and did not extend to the early project stages of a building project, and thus did not facilitate the formulation of better budget cost control theory. Zhan (1998) proposed the establishment of financial risk guidelines for an efficient project risk control system based on cost plans while at the same time he supported views similar to those of Egbu et al. (1998).

A standard cost planning process starts with a rough estimate of cost prepared from the client's brief. The client's requirements and needs are converted to a cost statement. The statement and the draft sketches are then converted into the first cost plan for the project.

At the sketch design stage a detailed cost plan is prepared to check cost against the detailed design. The detail design stage is the stage at which cost targets are set and cost checks on elements are carried out.

3.2.4 Summary of cost planning and control

This section has described issues in cost planning and control relating to effective budget prediction and management. It can be seen that the absence of risk indicators affects the accuracy of building forecasts and that this accounts for why the practice of cost planning and control has not achieved better formulation of risk planning and cost objectives.

Cost planning has been presented as related to estimating the total building cost, while cost control refers to the control of the defined costs during the design and construction processes. Cost planning is an experience-based process but, as has been shown, recent developments in cost estimating methods, and tools that consider risks and variability in cost planning and control, have not been adopted extensively by cost practitioners.

3.3 Approaches to financial management

This section is concerned with building funds and finance. It should be appreciated that buildings are developed predominantly in a commercial environment. Funds for building development usually have to be bought or borrowed from financial markets, where they incur an opportunity cost: even in the public sector, funds require a judgement of their benefits and a comparison with other forms of social investment. An examination of financial management theories should thus give an indication on how to treat potential financial risks once they occur in building projects. This section aims to focus on the economic and financial risk indicators that will be used later in the research design, and to discover how other researchers observe cost risk indicators in other management disciplines.

3.3.1 Cost management

According to Drury (1992), financial management is concerned with the allocation of financial resources in the most efficient way that would satisfy the client's building objective. Effective cost planning as part of that management, combined with risk management, forms a suitable tool for controlling capital resources. Correia et al. (2000) supports Drury (1992) and Lambrechts (1990) on the need for effective financial management, particularly as applied to a project cost, as the value of capital resources have to be maximized in order for the client to obtain value for money.

It has been shown in the financial management literature (e.g. Drury, 1992) that cost planning and cost control allow the client to obtain value for money, by means of financial risk indicators. Although risks are disruptive events or hazards or missed opportunities that interfere with planned cost expectations or estimates, the aims of cost planning are to help plan ahead for the project expenditure. However, risks expose these cost plans to cost impacts. The most obvious signs of these financial impacts are the cost disparities between the original budget and the final estimated cost, as described in Chapter 1. Drury's work (1992) established that financial management has the implied function of planning and controlling funds. However, his research did not outline details of the quantification of risk indicators shown in risk and cost management literature, or the building risks observed in project development. The financial risk exposures had unique risk indicators but none of the above-mentioned authors discussed this in their publications. At the same time, the findings of Macsporran and Tucker (1996) support Drury (1992) on the operating budget target which building owners, managers and consultants may aim at and attempt to achieve in building projects.

Despite the many differences between the findings of Drury (1992) and Correia et al. (2000), the authors agreed on the budget as an important cost management tool in project development for two reasons. Firstly, their findings in the context of financial management concentrated on policy outcomes, neglecting problems of unsuccessful financial policy applications. Some authors (e.g. Correia et al. 2000) suggest that financial factors affecting risk management might be represented by a group of risks with similar sources or by a single risk indicator or policies in the form of financial/budget guidelines, or capital rationing, in order to generate financial risks that affect the set building funds (Drury, 1992). In reality this has been evident in the building budget cost overruns experienced in some building projects. Secondly, budget guidelines can be clearly noted when a client has a capital rationing and a financial policy. Capital rationing is an absolute constraint on the amount of finance available, regardless of cost, whilst cost planning and control should always take place within a context of constraints of design and the client's requirements. Nevertheless, the project sponsor may decide to restrict the amount being borrowed or to be used, and this sets the cost ceiling so that capital budgets automatically limit the amount and the quality of work on building projects.

Regarding capital rationing; Correia et al. (2000) claim that the use of conventional cost risk indicators assumes that unlimited capital is available in the market, as long as its price can be met. In addition, restrictions are placed on the amount of finance employed, and this amount cannot in any way be exceeded. Thus cost rationing influences the various financial risk indicators which in turn affect building funds. However, the absence of risk indicators in financial management practices limits the accuracy of predicted cost plans affecting building finances allocated to a specific project. Al-Tabtabai and Alex (1998) concurred with Correia et al. (2000), saying that restrictions on capital outlay could be caused by internal management rather than external influences. These result in ineffective budget prediction and cost management that could possibly be rectified by the inclusion of selected financial risk indicators in the budget.

3.3.2 Monitoring of building funds

Monitoring is a process of measuring and correcting actual performance (Correia et al. 2000). The control process enables management to assess whether or not the objectives of the project are likely to be achieved (Drury, 1992). Monitoring in relation to risk management is a continual reviewing process aimed at evaluating likely risk indicators through their cost impacts (Baccarini and Archer, 2001). This process gives warning of potential problems and enables financial objectives and commitments to be changed before cost impacts occur in the project budget. This monitoring action introduces cost allowances for observable risk indicators in the funding of building projects (Brockington, 1996; Drury, 1992).

Lambrechts (1990), in his book on financial management, points out that cost monitoring goes hand-in-hand with cost planning and control. Moreover, monitoring ensures that building costs conform to cost plans and that cost objectives are achievable. He concludes that, by using the information gained during the cost analysis of similar previous projects, the use of available financial resources can be monitored, and effective control maintained of cost indicators in future projects.

The main purpose in monitoring the control system is to limit expenditure to the predetermined sum, as well as for encompassing the methods and procedures that direct consultants towards achieving their project objectives. The quantification of risk indicators is carried out to the extent that financial costs can be monitored but, in spite of this, risks are still likely to occur where there are restrictions on the development of a building.

None of the above authors determined that financial risk indicators affect building funds. Al-Momani (1996) states that budget disparities highlight the need to improve current monitoring practices, and a co-operative effort between concerned agencies is required to alleviate monitoring cost problems in construction.

3.3.3 Summary of approaches to financial management

Drawing from financial management theories, it has been shown that management is concerned with the financial resource utilisation of building funds and that cost planning is an essential financial management tool for controlling building funds. These allocated funds are at the discretion of the project sponsor and there is always capital rationing or a ceiling on building funds. This means that monitoring these funds remains important for effective financial management.

3.4 Approaches to the quantification and assessment of financial risks

Bearing in mind the discussion in Section 3.3 that the building finance comes from financial markets and that building should be executed under financial arrangements, it is considered justifiable to examine approaches used to quantify building costs and assessment. Financial quantification and assessment in buildings has been used with different objectives and this section examines different approaches to traditional cost quantification and the application of these methods to financial risks during the cost planning and control of building projects.

3.4.1 Forecasting

Georgoff and Murdick (1986) used a case-based research design to conduct a study on managers' approaches to forecasting. They conclude that forecasts should incorporate some subjectivity and quantification of judgement based on historical precedence. Despite this, a forecaster, who is required to make critical decisions on building costs, is typically equipped with only limited historical examples, meagre and questionable data, and changing theoretical tools.

Cortes-Rello and Golshani (1990) conducted a study on 'uncertain reasoning', using the Dempster-Shafer method; an application in forecasting and marketing management. Cortes-Rello and Golshani believe that the problem of incomplete, inexact or uncertain information appears in most information processing systems, especially in decision support systems. They conclude that existing knowledge on how to select suitable forecasting data is complex, incomplete and subjective. On the other hand, forecasting was identified as the basis for all budgeting and planning activities but may not be enough without the quantification of the financial risk indicators likely to occur in the building process.

Forecasts are needed to make decisions that affect the future (Drury, 1992). Brockington (1996) supports Drury (1992) while Creese and Li (1995) propose the use of local experience as chains of concepts for financial risk indicators which he sees as being even more informative than only local knowledge and experience when dealing with uncertain future situations. Al-Tabtabai et al. (1999) say that neural networks should be used for preliminary cost planning and risk management, because of the circumstances, limitations and requirements that often affect predictions.

Unfortunately the forecasting literature does not adequately describe the forecasting of risk indicators for forecasting generalised to other projects, and thus does not facilitate the better formulation of budget prediction. Nevertheless every forecasting situation is limited by constraints of information such as the availability of data, expected accuracy and urgency of the detailed forecast. The identification of risk indicators through a forecasting system, and the accrued benefits of quantification are believed to trigger awareness of cost problems and perhaps to offer the possibility of developing better forecasts. The multiple interactions of participants in the process of budget prediction were a source of new ideas for managing uncertainty and assessing the financial impacts of cost plans and cash flow forecasts (Putzer, 1995). Consequently, the communication between groups of professional building cost consultants – who are trained and experienced in budget prediction in different situations – offers diverse solutions to budget prediction. However, the fragmented nature of the industry, that mandates different requirements for different consultants, rarely encourages interactions between them, causing inadequate production of data that hinders effective budget prediction.

3.4.2 Estimating

The procedure for producing cost estimates, as documented by Drury (1992), involves making an analysis of the underlying physical quantities required for the activity in question and then converting the final results into estimates. This method is useful for estimating costs when input-output relationships are clearly defined. Unfortunately, at the early stages of a project, these relationships do not or may not exist, as there is often an absence of physical data. There is therefore a need to quantify risk indicators, to simply risk management (Uher, 1996; Ranasinghe, 1996; Drury 1992).

Cleveland (1995) conducted a study on definitive estimating for construction projects at remote sites, using historical data and direct experience. This study found that an accurate, thorough cost estimate provides the basis for a building budget, despite the fact that elements must be analysed and critical elements indicated. The estimating approach is useful in gathering information and identifying special considerations pertaining to particular projects. Skilfully carrying out assignments at the beginning of a building development would certainly result in guiding and coordinating budget prediction through the quantification of estimates. Cleveland (1995) concluded that estimators might initially rely on knowledge of project risks and historic databases of projects to estimate a building budget.

Cleveland (1995) argues that historical data are ineffective and subjective. This is in contrast to other researchers, for example Frosdick (1997) and Samid (1996), who is supported by Jeffrey (1996) regarding the idea of using case history analysis as an estimate baseline. According to

Samid, information and knowledge are gathered and inferences are drawn, resulting in a more valid budget. However an estimator may not have adequate prior project knowledge from which to make inferences. Songer et al. (1997) disagreed with Cleveland's (1995) findings, although their research did not consider the existence of financial risk indicators in building projects.

3.4.3 Summary of approaches to quantification and assessment of financial risks

In summary, this section has discussed different approaches to the quantification of financial risks and building cost assessment with limited physical quantities of the project. Forecasting has been described as a technique that aims to predict future costs by means of incomplete, inexact or uncertain information to quantify building cost with the aim of predicting the future cost.

It has been shown that some forecasts are produced using poor quality and/or meagre historical data while estimating, by applying an inadequate technique of analysing the underlying physical quantities. This impacts negatively on the accuracy of budget forecasts. The accuracy of these forecasts is crucial to the building project success and is highly sensitive to risk, and this justifies the quantification and incorporation of financial risks in cost planning and control by risk indicators.

3.5 Risk indicators in cost planning and control

Macsporran and Tucker (1996) showed that performance indicators of various types have been developed to measure building running costs. Such indicators act only as a guide, due to the differences in cost accounting (Atkinson, 1998). The absence of risk indicators in traditional forecasts is to some extent one of the likely sources of budget disparity between original and final costs. The following section aims to discuss risk indicators that are likely to affect cost planning and control procedures in traditional estimating situations.

The likely financial risk indicators affecting building budgets throughout the development stages are design variability, the client, characteristics of the budget, and expected accuracy levels. This section therefore reviews, *inter alia*, the need for financial indicators, the budgeting process, budget variability, quantification inaccuracies, uncertain variables, client diversity, accuracy, physical characteristics, market characteristics, and contract and procurement formulation.

3.5.1 The need for financial risk indicators

In recognising the risk impacts of building costs, it is important to determine the factors that generate them while estimating final building cost. According to Al-Momani (1996), the estimator might rely on developed risk relationships that can be used in risk planning and for estimating building costs. Identifying these disparities will validate the research problem stated in Chapter 1 and focus on risk factors and sources, as explored in sections 3.5.2 to 3.5.10.

The professional building cost consultant can experience difficulty in modelling the spatial constraints imposed by the project designer. At the same time the architect or the engineer may be unable to model the financial constraints within the limitations imposed on the project and possibly of a scarce information base. The relationship between risk management and cost planning can be traced to the financial risk indicators, and the relationship can be represented in a flow chart diagram showing the functions of a risk manager in cost planning and control. Thus it is necessary to understand the factors affecting building budgets, as illustrated in Figure 3.2,that arise from budget production and risk management structures. In the same way, risk management functions generate assessment problems, causing cost disparities that can affect the budgeting process.

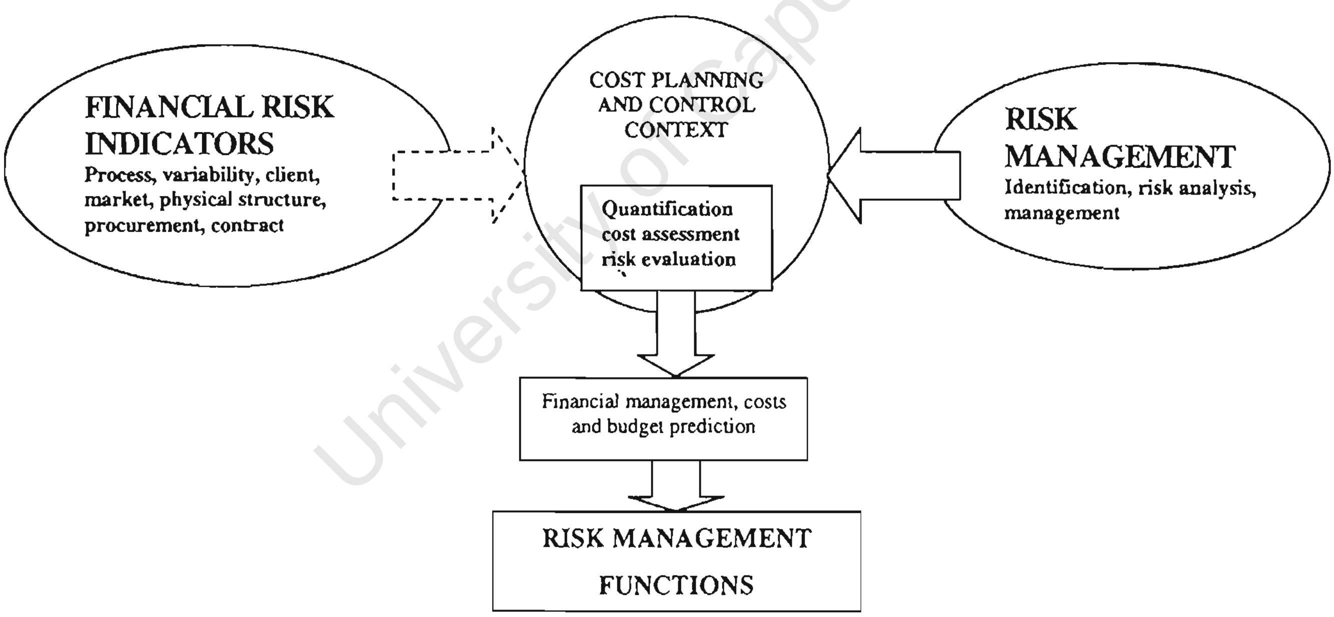

Figure 3.2 Conceptual model of risk management in cost planning and control[2]

[2] Adapted from Al-Tabtabai et al. (1999) and Diekmann et al. (1988).

Figure 3.2 also illustrates that when there is an absence of financial risk indicators in traditional cost planning and control, risk management functions are ineffective. Al-Tabtabai et al. (1999) conclude that estimates for project proposals are often based on inaccurate methods that do not consider specific project characteristics (financial risk indicators). Moreover, traditional cost estimating techniques usually use historical cost data to establish cost-estimating to generate estimates for similar future projects (Al-Tabtabai et al., 1999). Pender (2001) argues against Al-Tabtabai et al. (1999), saying that risk occurrence in one project might not be repeated in other projects.

In contrast to Al-Tabtabai et al. (1999), Samid (1996) had concluded that the necessary project information was often not clearly defined at early stages and was an inadequate base for cost prediction – hence the need for broad-based risk entities (Samid, 1996). Early stage cost prediction and risk investigation should determine these cost obstacles. The inclusion of budget prediction in traditional cost planning with risk management was insufficient in predicting building cost plan and budget prediction (Pender, 2001).

3.5.2 Budgeting processes

Putzer (1995) notes that the main purposes of budgets are to aid the planning process, to control costs, and to communicate cost plans to the various cost managers. The budgeting process ensures that managers plan for future operations. Capital budgeting specifically involves a process of allocating the financial resources of a firm in a manner that best achieves its overall cost objectives (Al-Tabtabai and Alex, 1998). In addition, the budget process relates to an entire activity or operation. The budgeting process encourages consultation between building participants so that they can anticipate problems before they arise. Budgets do not indicate the actual problem areas, but should guide the client on likely exposures to financial risk.

The budget process not only initiates dialogue on risk planning but also facilitates budget participation and communication between different building team members (Drury, 1992). Vital information is communicated in the act of preparing budgets (Bowen, 1993) – in contrast to the design-budget practice described above as being passive and unhelpful in the production of an effective budget. Despite the fact that the design-budget philosophy does not take the many risk indicators into account in the early stages, the causes of financial risks in cost planning and control remain within the service obligations of the cost practitioner. Moreover, budgets assist professional building cost consultants in cost planning and control, but in design-budget procedures financial risk indicators may not have been determined and quantified for inclusion into building budgets or into financial risk management. Raftery (1994a) and Flanagan and Norman (1993) concurred with Drury (1992) on the idea of budget procedures involving the establishment of a budget participation process.

Macsporran and Tucker (1996) conducted a study on target budget levels for building operation costs in 116 commercial buildings. They found that one of the most important building operation tools was a budget plan, set in advance and based on an anticipated set of circumstances as well as on the building environment. In a building environment the quantity surveyor, architect, client and engineer should participate in budget prediction in order to feel that he/she contributed to the process. These authors also established target future costs, but found that building characteristics such as size, location and quality need to be considered at the early project stages. These three risk sources were examined, and a methodology for determining targeted operation costs was developed in advance as a project cost and risk indicator.

Although these cost indicators cause quantification difficulties, when selected in advance they should also show achievable cost targets. Independent factors as size, location and inflation offer the possibility of a better-cost measurement and quantification in the budget process. Macsporran and Tucker (1996) postulated, and Samid (1996) agreed, that results from the target budget provide a baseline cost plan and control, forming an improved method of determining risk indicators in budget prediction. Target budget and risk indicators, based on anticipated circumstances, might not have been determined when budgets were calculated in advance. This could cause financial risks in cost planning and control which might emerge later if the design is changed (Samid, 1996).

3.5.3 Budget variability

Bennet and Ormerod (1984) reported on the dangers associated with pricing budget items derived from bills of quantities. They found that it is fairly common for a reasonably accurate detailed budget to be invalidated by a single lump sum addition made hurriedly, and with little consideration of the resultant cost implications. They concluded that preliminaries variability was such a risk indicator, especially in projects that demonstrate great budget variability potential. In spite of this, the design should reach a fairly advanced stage before a definitive budget is initiated. Risk indicators offer a solution, for example when there is a lack of design detail and a need for budget plans to be determined before the detailed design is finalised.

Al-Tabtabai and Alex (1998) used artificial intelligence to examine an evolutionary approach to the capital budgeting of construction projects of large contractors in Kuwait. They found that major construction firms often face difficulty in budget cost advice, mainly as regards the optimum combination of project inputs. They make the point that cost advice requires the evaluation of all feasible combinations of project inputs and risk variables, including the highest probability of an event or activity occurring and, in their opinion, conventional statistical and mathematical methods are inadequate in representing human feelings and result in imprecision of communication and poor descriptions. Even when additional information is available, there is no adequate guide to budget formulation. Conventional methods are not practical as the capital budgeting problem is large and poorly understood – as is budget prediction.

Macsporran and Tucker (1996) suggest that when there is an absence of risk indicators in the budget details, the project information base becomes a problem at an early stage. A method such as artificial intelligence need mathematical and computation skills in their application, but the determination of risk indicators in traditional cost planning does not require complicated tools in order to apply to financial risk management. Macsporran and Tucker (1996) view of accuracy in budget contrasts with the findings of other researchers, for example, Al-Hajj and Horner (1998), Frosdick (1997) and Mak (1992), who showed that an increased use of mathematics in estimating did not improve forecasts. It should, however, be noted that the use of qualitative measurement with likely cost and risk indicators has not yet been researched sufficiently to facilitate a formulation of budget prediction theory.

3.5.4 Quantification inaccuracies

The literature (e.g. Mok et al., 1997) has noted that traditional methods are still being adopted in estimating building costs. Their work shows a concentration on approximate quantification in the various stages of refinement. Brandon and Newton's (1986) study on improving quantity surveyors' forecasts, using a theoretical analysis of knowledge and experience, revealed an almost exclusive concentration on approximate quantification in the various stages of building cost refinement. They say that approximate quantification is often used too late in the development of building projects. They also conclude that the approximate quantities method does not aid estimation, because it requires details and project information that might not be available for the purpose of project quantification.

The findings of Brandon and Newton (1986) points out that there is a need to model some of the routine experiences and knowledge that a cost practitioner employs in preparing cost estimates. The cost model should allow for human judgement exercised by the cost practitioner in their work. In addition, the complexity of building works, communication channels, the attitude of practitioners, insufficient or inappropriate design information, misinterpretations and inter-relationships between disciplines should be made explicit, to improve budget prediction. Their approach did not consider improving risk quantification and the discovery of risk indicators in financial risk quantification and management. Schumacher (1996) and Ock (1996) upheld Brandon and Newton's findings in support of budget prediction with enhanced forecasting techniques if there is a lack of adequate project information.

Both Kaka (1996) and Ranasinghe (1996) used historical data to develop models directed towards more flexible and accurate cash flow forecasting. Their studies found that traditional cash flow forecasting models are inaccurate and inflexible in terms of the extent of variability of the risk profiles produced. In spite of this, and in order to test the accuracy and variability of risk profiles, 50 variables that might contribute towards building risks were used in the forecast model in Kaka's (1996) study. He demonstrated that, by merging risk variables into groups or clusters, the flexibility and reliability of forecasting, which includes budget prediction, is enhanced.

Kaka (1996) found that the effectiveness of traditional models would be enhanced if they incorporated further variables. He concluded that budgets are highly sensitive to risk, particularly design variations, data variances, duration overrun and under-measurement, all of which relate to the need for a detailed building programme and bills of quantities. Ranasinghe (1996) on the other hand considered the forecasting of inflation rates to accommodate the short time available to gather adequate data, although he said that the lack of associated cost data justifies the quantification of these risks through their risk indicators. Macsporran and Tucker (1996) in their study of target budget costs and total project costs found that building cost data need to be improved if any further significant risk relationships are to be identified in the cost planning of target budgets. Ranasinghe (1996) supported project quantification by the use of a simplified total project cost model during cost assessment.

3.5.5 Uncertain variables

The construction process is characterised by complexity and uncertainty but, notwithstanding uncertain variables, probability theory offers the possibility of developing a cost prediction model that allows for better incorporation of risks in cost planning and control. Uncertain information associated with cost forecasts affects the total predicted budget, and in a state of complete uncertainty, forecasting fails to quantify all the possible impacts on the building project (see

Ashworth and Skitmore, 1982). On the other hand, the dominant presence of uncertain variables in the quantification process militates against the production of accurate cost forecasts by numerical analysis and synthesis alone – as happens in conventional budget prediction. This in turn affects the determination of risk indicators, which would probably also affect cost planning and control in financial risk management. Skitmore et al. (1989) and Morrison (1983) concurred with Ashworth and Skitmore (1982) regarding the idea of forecasting in advance, using cost variables such as risk indicators to aid budget prediction.

Kaming et al. (1997) disagree with Skitmore et al. (1989), contending that cost variables are too diverse and loose to be evaluated directly. They used a survey questionnaire to examine factors influencing construction time and cost overruns on high-rise projects in Indonesia. The study found that many variables, for example project location, can impact negatively on the building cost, and ineffective cost planning methods are likely to cause inaccurate estimates. Other variables they identified were inflationary increases, inaccurate estimating of project complexity, design changes, poor productivity (site management) and inadequate planning. Unfortunately they do not offer a better formulation for budget prediction of factors affecting the estimation of final building costs.

Kaming et al. (1997) further note that inflationary increases, uncertain variables in budget estimates and project complexity are some of the causes of cost overruns. Their study was undertaken with project managers who ranked variables according to their perceived importance and frequencies of occurrence. Factor analysis technique was used, and cost overrun variables were grouped into factors and their relationships analysed. They report that the predominant causes of uncertain variables can be found in design changes, ineffective risk management and inadequate cost planning.

Kaming et al. (1997) suggest that factors such as inaccurate estimating and inflationary increases, frequently contribute to building risk. This was also noted by Kaka (1996) as a problem in the costing of building projects. The most obvious sign of cost overruns is the risk indicators caused by uncertain variables in financial risk management. This justifies the formulation of part of the research problem stated in Chapter 1.

The findings of Pedwell et al. (1998), as well as those of Chan and Kumaraswamy (1995), on the idea of further investigation into uncertain variable relationships, point to the need to identify risk indicators (in terms of project risk characteristics and variables).

3.5.6 Client diversity

Pedwell et al. (1998) and Jeffrey (1996) agree with the conclusions of Raftery (1994b) regarding the human aspects of risk management, finding that when it comes to a gamble – in this case making a decision to build – different clients react differently. Pedwell et al. (1998) conclude that clients can be categorised as risk-neutral, risk-seeking or risk-averse. Successful business clients are perceived by them as risk-seekers. Clients have different risk perceptions, for example, the type of project, project objectives or budget prediction may influence a client's risk characteristics, later affecting financial risk management. In addition, the type of project – housing, industrial, commercial, engineering, renovation or maintenance – is a factor in client diversity. Nevertheless, client characteristics are seldom recognised in financial management (Jaafari, 2001).

Evidence of client influence on cost can be seen in the oil and gas industries (Pedwell et al., 1998; Jeffery, 1996) where client desires may be similar but the techniques for achieving them are varied. Pablo (1997) found that results depend on client financing policy, client project perception and project diversity, resulting in different project strategies. Pedwell et al. (1998), however, differ in their emphasis on variable management strategies, and do not focus on risk indicators that affect risk management and cost planning.

Kometa et al. (1996) studied the client-generated risks of construction consultants, that is, firms of architects, consulting engineers and project managers, in a questionnaire survey of 29 consultants. They studied the validation of a model for evaluating client-generated risk, measuring risk variables (exposures) such as project feasibility, client duties, financial stability, past performance, project characteristics, organisational quality, past experience, quality of management, current market conditions, communication, and the type of client. They conclude that client projects have different cost attributes, which affect project implementation, as well as different risk indicators, which affect budget prediction.

Client-generated risks may cause misunderstandings that can jeopardise an entire project; for instance, building clients might change requirements that might then conflict with, or effectively redefine the project objectives. However, Kometa et al. (1996) stated that consultants should determine potential clients' risk indicators, in order to take corrective action in terms of the proposed budget. The absence of risk indicators in client-generated risks is, therefore, recognised as an issue for risk investigation. Both Chapman (2001) and Ward (1999) support the idea that client aspirations may not be suitable for the given project.

Barkham (1997) used the CEOs of a property company in interviews and questionnaire surveys in order to study the financial structure and ethos of property companies in Britain. He found that client organisations vary in their size and project objectives, their strategies, their approach to risk, and their organisational structures. In addition, he found that business decision-makers are often highly risk-averse. He concluded that clients might spend considerable time and effort minimising those building risks that they take as critical – as evidenced from commercial property development. Furthermore he hypothesised, as had Scott (1995), that the approach to the financing and financial management of property investment and development also varies between clients, as does budget facilitation between projects.

Barkham (1997) reports further that even clients with minimal requirements may demand assistance in the prediction and allocation of building funds. A client may approach the task of building development with different motives and strategies, but it is possible to determine the type of client that could be associated with higher risk financing and high project demands. However, these are risk indicators generated by the character of the client, and their appearance offers the possibility of developing recommendations to change practices in high risk financing and in cost plans (Scott, 1995). As a result, client project funding may offer better practices for facilitating the formulation of better budget prediction theory than local experience and risk knowledge in building projects.

3.5.7 Accuracy of estimates

Empirical studies indicate that the professional building cost consultant should be able to produce budget plans with a coefficient of variability of between 12 and 19 percent (Pearl, 1992). Ashworth and Skitmore (1982) had revealed, in contrast, that there was a wide variety of expectations and opinions regarding the accuracy of budgets. These accuracy expectations usually lack any supporting data and therefore cannot be sustained. In any case, the accuracy of price forecasting has always been questioned, due to the amount of uncertainty in the relevant data (Pender, 2001). Most cost research, for example, Pender (2001) corroborates Ashworth and Skitmore's (1982) earlier contention that there is little basis for reliable empirical evidence of budget accuracy from which effective budget plans can be generated. Budgeting accuracy does not improve with additional project information in the manner expected, particularly when experienced estimators are used (Skitmore, 1987). Moreover, risk indicators should be used to give some accurate guidelines on budget expectations.

Like Skitmore (1987), Al-Hajj and Horner (1998) investigated the cost data published by the Building Maintenance Cost Information Service (BMCIS, 1984). They found that the data contain so much detail and analysis that they hinder subsequent data gathering and organisation. These researchers used 11 cost-significant indicators that could predict the total running cost of a building to an accuracy of about 2.5 per cent. They then predicted the budgets of twelve new buildings, but were within only 7 per cent accuracy of the received building cost, showing that expected accuracy levels are difficult to achieve with budgets based on limited project information. They concluded that accuracy, as a risk indicator, exists in cost planning but should be used as a guide only. Likewise, lack of usable information either about the real costs of building, or of different components fulfilling the same function, made building cost accuracy difficult to achieve, and thus indicating the importance of risk indicators. Principally the continuing absence of reliable data (Al-Hajj and Horner, 1998), lead to the conclusion that budget prediction accuracy close to 10 per cent is the best level of consistency that can practically be accomplished (Skitmore et al., 1989). The establishment of cost guidelines does not facilitate the formulation of accurate building budgets, making apparent the need for risk indicators.

Notwithstanding budget accuracy variability, Fitzgerald and Akintoye (1995) used a similar approach with Building Cost Information Service (BCIS, 1987) data to assess the accuracy of submitted tenders through quantitative methods. Their findings indicate that cost forecasts are not usually an accurate estimation of actual cost, and that forecasting error of building price movement has to be established from the nature of the current building market. Fitzgerald and Akintoye (1995) conclude that cost planning is pitched at such a level of detail that the amount of data collected and analysed may be a constraint, with a resultant reduction in the expected accuracy level (forecast error) varying from 6 to 33 per cent. In addition, improvement on forecasts can either be through changes in the technical approach, made by adopting explanatory and logically transparent forecasting methods, or by removing forecast bias. The findings of Bowen (1993) agree with those of Birnie (1993) as regards reducing cost planning accuracy bias by introducing unbiased costing situations, particularly when high accuracy levels are demanded. Mok et al. (1997) express similar opinions, although their area of focus was on building services estimation. It is therefore believed that the identification of risk indicators in the first place could improve budget accuracy.

3.5.8 Physical characteristics

Chan and Kumaraswamy (1995) investigated the relationships between different physical variables such as construction duration, construction cost, total floor area and number of storeys. Using a pilot and survey questionnaire they attempted to analyse macro- and micro-factors that affect the building costs of projects. Only 111 of the 400 respondents responded, giving a response rate of 28 per cent. The questionnaire was followed up by case study interviews to clarify any unclear responses, and to obtain a realistic picture of the operation on site as well as of the building users. The researchers concluded that the quantity surveyor's ability to estimate can depend on the physical characteristics of the project, and on individual client intuition. Moreover, the details of the project can depend on the skill and experience of the planning consultant, as well as on the type of client and the site characteristics. Knowledge of physical characteristics could improve budget prediction, thus facilitating the formulation of a theory of budget prediction with only limited project information.

Gidado (1996) conducted a study of project complexity, defining it as a measure of difficulty in implementing a planned production. The primary aim was to establish the relationship between project complexity and monetary cost. Cost and time interact with each other and an increase or decrease in time may or may not increase or decrease cost, and vice versa. Risk indicators representing physical characteristics of projects can probably deepen fundamental understanding of the building budget and may create new possibilities for assessing of costs. The physical structure may increase the demand for both cost and time resources, but the production process can also be affected by external factors such as the stakeholders and the environment.

The relationships between the physical characteristics of a building and the likely final building costs were found by Akintoye (2000) to be important in estimating the building budget. The physical development process creates opportunities for risk drivers to trigger cost impact cycles, and there would be a chance here to determine risk indicators through assessment of those physical characteristics of a building that affect cost planning in financial management. The findings of Idris (1998) support the assessment of physical indicators that influence costs and physical uncertainties. Without an empirical knowledge of the physical characteristics of a building, theories for improving the budget are limited to local experience and previous similar project information.

3.5.9 Market characteristics

A lack of standard information represents a special risk indicator in terms of the market interacting with the building procurement process. According to Zelouf (1995), the disparity observed in building market costs stems from the different building market perceptions of the various estimators, thus causing possible estimator risk. The prevailing bid market explored by Zelouf (1995), who examined government and institutional projects, showed a lack of market guidelines in costing. Indeed, in using standard drawings as well as market characteristics and the future building, he found that government building cost estimates compare favourably with low contract bids. Despite a knowledge of the physical characteristics of a project, the basic question remains: how can the costs of buildings with similar physical characteristics, drawn from the same market, be significantly different? Undoubtedly buildings are different, but a lack of standardisation might be one of the main causes of disparity between estimated and final costs.

Lack of codes and building standards have varied influences in market price characteristics, as the estimate and the low bids can differ considerably. In only a few isolated case studies has there been any in-depth investigation of the market risk indicators which link costs and budget prediction. Building budgets for similar risk indicators may be different due to a lack of generally acceptable cost guidelines (Hegazy and Moselhi, 1995).

The fixed location of buildings makes each unique, so that although they might be of similar design and even built in the same vicinity, their individual positions create differences in certain features and cost values. Pender (2001) maintains that a building cannot be repeated on different sites, and opportunities to recycle statistical information are thus limited. Furthermore, market knowledge gained from previous projects often does not generalise well due to design changes (ibid.). Market characteristics may identify the operation-related attributes that influence building processes, and a building's fixed location cannot be changed to allow it to enjoy the market characteristics experienced in a different location. Zelouf (1995) identified market perceptions derived from market indicators as a tool for cost advice on budget prediction.

These unique qualities prevent a professional building cost consultant from using average market characteristics in order to determine accurately the building cost of a specific building project. In other words, each building project must be individually appraised. This applies also to financial risk indicators generated in the building market. Shash (1995) found similar subjective assessments in the competitive bidding system that did not facilitate the formulation of accurate budget prediction without adequate project information.

3.5.10 Contract and procurement formulation

Senior (1990) found that contract problems tend to first occur at an early stage. However, they may not be revealed until some time during the detail design or after entering into a contract or while examining risk and uncertainty in lump sum contracts. A poorly formulated contract can create administrative and technical as well as financial problems, that expose the client to financial risk. Senior (1990) believes that cost impacts originate from poor design, inadequate project information, poor organisation, as well as poor methods of communication, planning and cost allowances. These issues affect procurement methods – such as open tender, selected tender and negotiated contract – in different ways. The budget can become affected by unexpected contract conditions creating a fundamental misunderstanding of the information system as regards contract and procurement risk indicators.

Additionally, building budgets rely on the accuracy and sufficiency of the information provided, undoubtedly affecting the efficiency and effectiveness of building budget prediction. Senior (1990) claims that traditional forecasting should require that designs be substantially complete and fully documented prior to budget prediction. He concludes that risk evaluation difficulties are usually generated by the actions of others associated with the building project. The contract and the type of procurement conditions will trigger risk indicators that appear with contract formulation and financial risk management. Arshad (1995) expressed similar opinions regarding equipment procurement information systems in residential air conditioning in Saudi Arabia, stating that contracts, as well as cost prediction, can fluctuate widely if contract and procurement indicators are not established early in the project development. Procurement methods such as design and build, construction management or build and operate, require adequate pre-project information before a decision to build is undertaken (Songer et al., 1997).

3.5.11 Summary of risk indicators in cost planning and control

Section 3.5 has described risk problems encountered in cost assessment during cost planning and control. The section demonstrated that risk indicators exist in cost planning procedures and practice, and these are generated by budgeting procedures, variability of cost data, quantifying risk factors and inaccuracies in measurement, uncertain variables, client diversity, physical characteristics, market conditions and the type of contract.

3.6 Summary

- The essential background to cost planning and control was discussed and explored in this chapter. Risk indicators in cost planning and control in a financial management context were also examined.

- Cost planning was noted as relating to estimating total building costs and identifying those amounts applicable to the respective elements. Cost control has been taken as referring to the control of defined costs during the design and construction process.

- The issue of financial management was explored through a discussion of various cost management theories, and it was noted that there is invariably capital rationing or a ceiling to the building funds available.

- Approaches to quantification for budgets were explored through forecasting and estimation. Additionally eight risk indicators in budgets were identified: budgeting, quantification inaccuracies, uncertain variables, budget variability, client diversity, physical characteristics, market characteristics and the type of contract.

- It was shown that risk issues associated with cost estimates are seldom explicitly quantified when forecasting building costs. Issues represented by risk indicators might influence the development of adverse events and result in lost opportunities, which in turn cause cost impacts. The determination of risk indicators seemed to be a better way of quantifying adverse events. It is necessary to consider financial and technical obstacles in cost planning and control procedures within the context of financial risk management. The literature revealed only limited use of risk financial indicators in traditional cost planning and control practices which affect building costs forecasting.

Research into risk and risk management is essential if improvement and effectiveness in budgeting as well as cost planning and control are to be achieved, but there has not been any satisfactory formulation of budget prediction. The choice of budget prediction technique depends on the nature of risk experience and knowledge, together with the identification of risk indicators that represent the effect of an event or activity, as well as on how much knowledge can be elicited from the cost practitioner.

The literature review of the empirical evidence in the field of risk management research justifies the research problem as stated in Chapter 1. It was found that a holistic and integrative building budget framework is needed in which cost planning and control procedures facilitate risk budgets by proactive risk identification, assessment and management. It was against this background of budget complexity and information uncertainty that the research problem was observed and structured. Hence the postulation that "the risk management functions exercised by the professional building cost consultant in cost planning and control are ineffective" (Chapter 1).

In summary, this chapter has presented and explored cost planning and control risk indicators and investigated how other disciplines, particularly financial management and costing, deal with risk problems as a base for financial risk management. An investigation into building budgets, the risk environment and the treatment of potential risk indicators in building projects has now been justified.

CHAPTER 4

Building Budget, Risk Identification and Treatment of Potential Risks

4.1 Introduction

Chapter 3 described risk indicators from the points of view of financial management and of planning and cost control. This chapter attempts to identify the risk indicators employed in financial management, in order to validate the research problem stated in Chapter 1, and also to investigate why risk management in cost planning and control is often ineffective in building projects. The primary data collection instrument along with the research methodology is described in Chapter 5 and the results are discussed in Chapter 6.

The need for an effective and reliable financial cost plan is demanded by institutions for the purposes of financial control and risk management. At the time a project is commissioned documentation is needed on the proposed project together with its expected building budget.

This chapter describes the building budget (Section 4.2), risk identification and measurement (Section 4.3), the management of risk drivers (Section 4.4), the treatment of potential risks (Section 4.5), and terminates with conclusions (Section 4.6). It addresses the question:

What are the primary sources of risk in a building project, and how can they be identified to aid budget prediction?

4.2 Building budget

Section 4.1 indicated the need for effective financial risk management in order to guide project development as described in Chapter 3. Section 4.2 demands an understanding before identifying the causes of ineffective budget prediction. This section discusses the building budget environment (Section 4.2.1), the effects of project development on the budget (Section 4.2.2), projects and participants (Section 4.2.3), risk environment (Section 4.2.4), risk analysis (Section 4.2.5) and ends with a summary of the discussion on the building budget (4.2.6).

4.2.1 Building budget environment

In Chapter 3, Section 3.5.8, it was noted that once a building development has started it is extremely difficult for the client to withdraw without suffering financial loss. External financial constraints imposed on the design are at times outside the control of building participants. The imposed constrains could be incorporated into budget prediction if such risks could be anticipated in advance. Constraints might disrupt the progress of the project and interfere with set cost plans. Both external and internal financial risk factors may impact on the building budget, causing a cost overrun or a saving which is a disparity between the original budget and the final building cost.

The effects of external factors and sources of cost impacts might interfere with cost planning procedures so there is a need for a better understanding of the building and budget environment. First of all, the ability to quantify cost impacts and the changing building environment had a profound effect on the budget. Secondly, there are obvious advantages in being able to monitor the utilisation of funds in the progression of a building development (cost management), as well as gauging the effectiveness of the risk measurements taken and the treatment of potential risks.

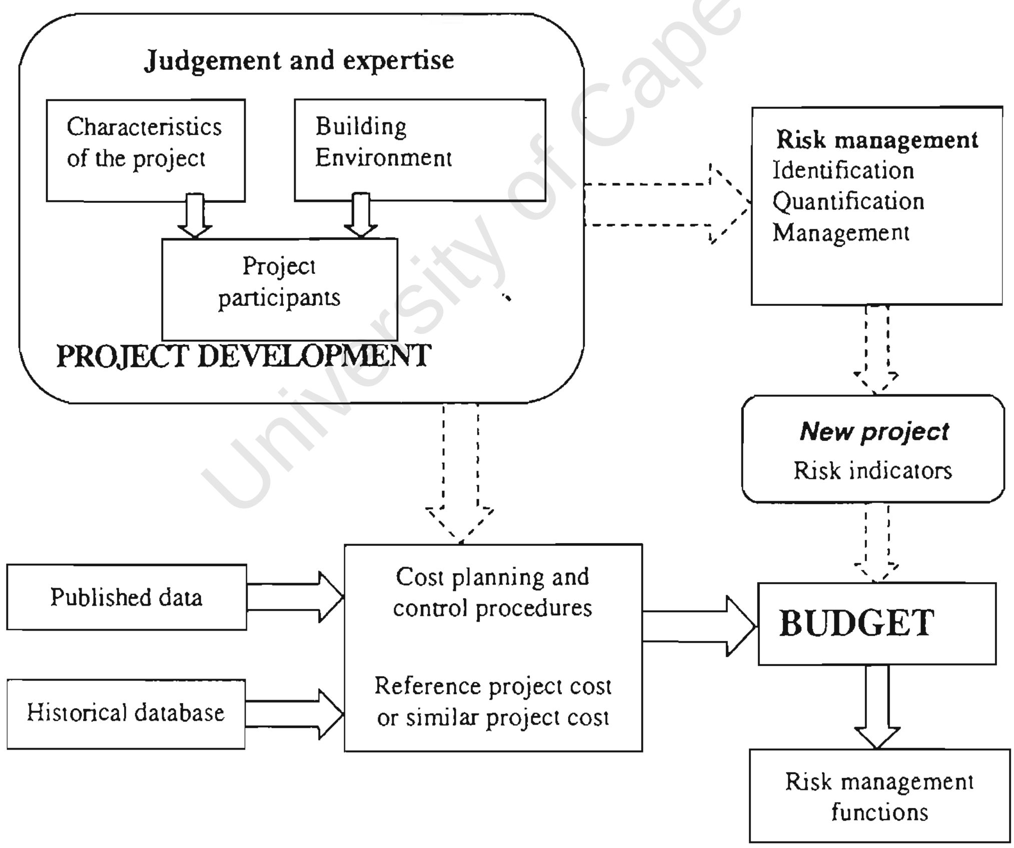

Figure 4.1 Environment in which cost estimates are produced[3]

[3] Adapted from Al-Tabtabai et al., 1999.

The building budget environment can be defined as the internal and external surroundings that influence building activities, and is determined by those events and needs of society that make the client incur costs in the process of developing the physical structure (Al-Tabtabai et al., 1999). Buildings also have an influence on the environment (the world outside the building development) in which they are erected, to an extent that is largely, but not entirely, dependent on the needs and requirements of the project, the stakeholders and the building end-user (Smith, 1999). Such a budget environment is depicted in Figure 4. 1.

Figure 4.1 illustrates the environment in which the building budget is predicted. Cost information is derived from published data and a historic database, but these should be controlled and judged against the project characteristics and the type of participants. Later in this chapter, risk identification, quantification and the management of likely building risks will be assessed and evaluated through risk indicators which are determined for incorporation into the final building budget.

4.2.2 Effects of project development on the budget

Budgeting includes a process of allocating financial resources to building development in a manner that best achieves its overall cost objectives (Al-Tabtabai and Alex, 1998). It also provides an approximate indication of the total project cost during the pre-contract and construction stages, and is therefore prepared before or during the early stages of preliminary design (Al-Tabtabai et al., 1999). A building budget offers a guide to project development, and even then, each project has its own unique set of risks. By assessing these multiple sources of risks, stage by stage, according to how they affect building development, the developer or sponsor may evaluate each risk within each stage (Rutgers and Haley, 1996).

A project can be divided into the usual six stages of development in terms of budget prediction at one of the following stages: inception and brief, feasibility, sketch design, detail design, tender, and post-tender. The budget prediction stage is concerned with the early building development and preparations for initiating commencement of the works (Rutgers and Haley, 1996). In addition, Diekmann (1997) pointed out that the effects of multiple uncertainties should be accounted for when establishing budgets. Analysing building project risks in stages is important to risk assessment; so potential problems can be separated and evaluated at each stage of project development. However, each stage has its own risk so that it is necessary to determine risk issues at each stage.

4.2.3 Sources of risk in building

The goal of knowing the common sources of building risk is to enable professional building cost consultants to assess and manage the uncertainties in a project so that final project costs are closer to the original budget estimate (Diekmann, 1997). The findings of Pedwell et al. (1998) were that an owner's influence was greatest in the early stages of a project, thus justifying the need for early budget prediction and the setting of risk priorities to ease future risk evaluation for the client's budget.

The Code of Practice (1985) and the RIBA Plan of Work (1980) describe the earliest development stage of the project as concerned with value management, to improve the definition of the cost objectives. The 'early project development stage' can be defined within the framework of the RIBA Plan of Work (1980) as the stage during cost planning and control service at which budget limits are established and the overall building budget estimate is set (Bowen, 1993). According to Smith (1999), the range of possible options for the development of a building is broad at the early stage, but this can bring in a lot of uncertainty both, physical and financial, with regard to cost impacts. Participants have a wide choice of different forms of designs and materials before the actual building phase and changes can easily occur.

Budget assessment and the nature of the risk itself changes with time, but as the project develops, more building information is confirmed. The facilitation of budget theory and the setting of indicators to represent risk exposures might improve risk assessment for budget prediction at the early project stages.

4.2.4 Project participants

Project construction obviously generates risks that may not relate to human failure but, for effective risk management, it is essential to know who the main role-players are in working on a project, as well as to understand the ideas of each of them regarding risk in building projects.

The literature, for example Edwards (2001) and Kometa et al. (1995), identifies the project owner (client) and the contractor as 'major project stakeholders'. Cheung et al. (2001) and Adams (1997) identify similar lists of stakeholders in the building project, but they are more concerned with involving a cross-section of professionals from the construction industry, to aid in developing an accurate budget. Wide consultation between different disciplines and participants involved in the building project is indeed essential at the early project stages, particularly when setting the project budget.

Building professionals such as architects, engineers and quantity surveyors were considered by Adams (1997) to be major contributors in coping with financial risks. Additional agents employed in the building team were the structural engineer, the building services engineer and an estimator. Kartam and Kartam (2001) and Cheung et al. (2001) also propose such a list of participants. However, their study does not include the contractor, as his or her obligations and terms of engagement in the building project are different from those of the cost consultants. Moreover, building consultants are the agents of the client through whom changes and guidance are expected in the project management, whilst the contractor is not a client's agent. The selection of appropriate risk indicators is subjective and dependent on the type of stakeholders and their experience in budget prediction. The type of participant is thus of major importance in determining and controlling risk issues as they arise in the development. Whereas the contractor is outside the scope of this study and the early stage budget prediction, other stakeholders in the project can expose the client to financial risk indicators at the early project development stages.

The absence of financial risk indicators arising from misjudging, missed chances or opportunities, or from poor selection of participants, can all contribute to risk issues in building projects, and are all attributable to human error or to mismanagement (Atkinson, 1998; Frosdick, 1997).

Liu and Walker (1998) examined the evaluation of the project outcome process through examining the participants' behaviour in building projects. They found that risk complexities that underlie budget evaluation are derived from project financial goals, participants' behaviour and possibly the performance of project organisations (although this last one has been the subject of unresolved debate for many years). Liu and Walker (1998) concluded that earlier studies did not recognise the manner in which individuals' perceptions of project budget influenced the range of factors in each expert's perception of risk. Thus risk indicators could, to some extent, be interpreted as human failure in judging information, due to the participants' different perceptions of risk.

The identification and interpretation of factors of influence – such as *ad hoc* management structure (self-efficacy), project goals and variables – are fundamental in the researcher's understanding an individual's perception of risk (Pablo, 1997). For example, contractors' estimates vary, and different professional building cost consultants produce different estimates for the same work (Zelouf, 1995).

The budget variability and risk indicators observed are project-specific and affect cost planning and financial risk management. White and Fortune (2002) found that project participants use different criteria to judge their own success, supporting Liu and Walker's (1998) contention that budgeting problems are very often due to different approaches to evaluation, which in turn are dependent on project and participant perception (see also Pablo, 1997). Liu and Walker (1998) and Pablo (1997) recommend the establishment of a common list of critical success factors and/or risk indicators, resembling a group risk cluster which can be represented by an individual risk with similar characteristics.

Edwards (2001) examined risk perceptions and communication in the risk management of construction projects and found that there were differences in the risk perceptions of the various clients and consultants involved in the process. A further problem exists regarding the diversity of participant objectives, and the way in which these participants relate to the temporary nature of their association. Edwards (2001) concludes that building development uses an *ad hoc* management structure which does not result in a common obligation but rather in ineffective participation in budget preparation.

Nevertheless, the teams – from quantity surveying, architectural and engineering firms – are co-participants in project management, although they do not necessarily enter into formal partnership arrangements. Client participant ranges from individuals through to companies and in each category include both speculators and investors.

For budget evaluation and risk analysis purposes, it is pertinent to classify clients according to their short or long-term project objectives. Short-term participants are primarily concerned with the difference between the total cost of the project and its probable market price on completion. This results in two problems. Firstly, the situation creates financial risks through the improper judgement of situations or unknown characteristics that in turn are reflected as risk indicators. Secondly, the absence of risk indicators at an early stage causes poor perception and communication of project needs (Loosemore, 1995) – hence the need for a better understanding of risk indicators.

4.2.5 Risk environment

Rutgers and Haley (1996) used a case study of historical data to examine project risks and risk allocation in the San Francisco area. They found that for consultants to fully understand risk assumptions, they need to appreciate the overall commercial structure, for example, sources of finance, the funding process and shareholders/equity/owners. They concluded that the ability and desire of all parties to commit funds to the success of the project must be considered before its commencement (something which, surprisingly, is not always done). In addition, the success of a project and the effectiveness of the budget prediction depend largely on the effectiveness of the risk management participants.

The terms of project budget prediction demand sensitivity with regard to financial risk management, cost planning and cost control procedures. Even after the incorporation of the cost impacts of risks and their management, the effectiveness of the cost budget has to be sustained, for example, by controlling cost targets. If risk impacts are eliminated, reduced, or transferred to the appropriate parties, the client will worry less because the possibility of a future cost impact has been foreseen.

If risk management is to be transferred to a willing (third) party who has the skills to manage the risk, then the possible cost impacts through risk indicators need to be determined beforehand. Meanwhile, probable exposure to budget variability would be abstracted from the project information as risk indicators, and assessed, so that the cost plan could be adjusted accordingly. According to Lowe and Whitworth (1996), there might be consensus regarding the cost approach in financial risk indicators if identification of significant risk is done early enough before budget prediction commences. An ineffective budget cost prediction might result – as suggested in the literature, for instance Kim and Bajaj (2000) and Chan and Kumaraswamy (1995) – because future risks may not be identified from the historical data. Figure 4.2 depicts some of the problems encountered by the budget estimator in the cost planning process.

Figure 4.2 indicates that there are costs outside the basic cost plans that are not directly under the control of the consultant team. Additional costs may be generated by users, financiers and other stakeholders, environmental circumstances and so on during the development of the physical structure. All risks that could affect the building should be evaluated, for incorporation into the initial building budget, although this can create cost prediction problems.

Hartman and Jergeas (1997) used theoretical data to simplify project success metrics and discovered that, at the outset, projects are normally defined in terms of their contribution to the built environment, for example area occupied or number of storeys. They also maintain that current evaluation and assessment techniques for building risk, which are adapted from traditional cost management and control methods, are likely to be limited in their applicability in the quantification of future events (Pender, 2001). However, risk frequency, impacts and responses must nevertheless be evaluated at some stage of the project. Hartman and Jergeas (1997) point out that a high degree of complexity or uncertainty can be generated by the project development itself. The use of development stages would simplify project quantification and the identification of risk indicators, and in this way simplify budget prediction. This could be done through qualitative terms and descriptions.

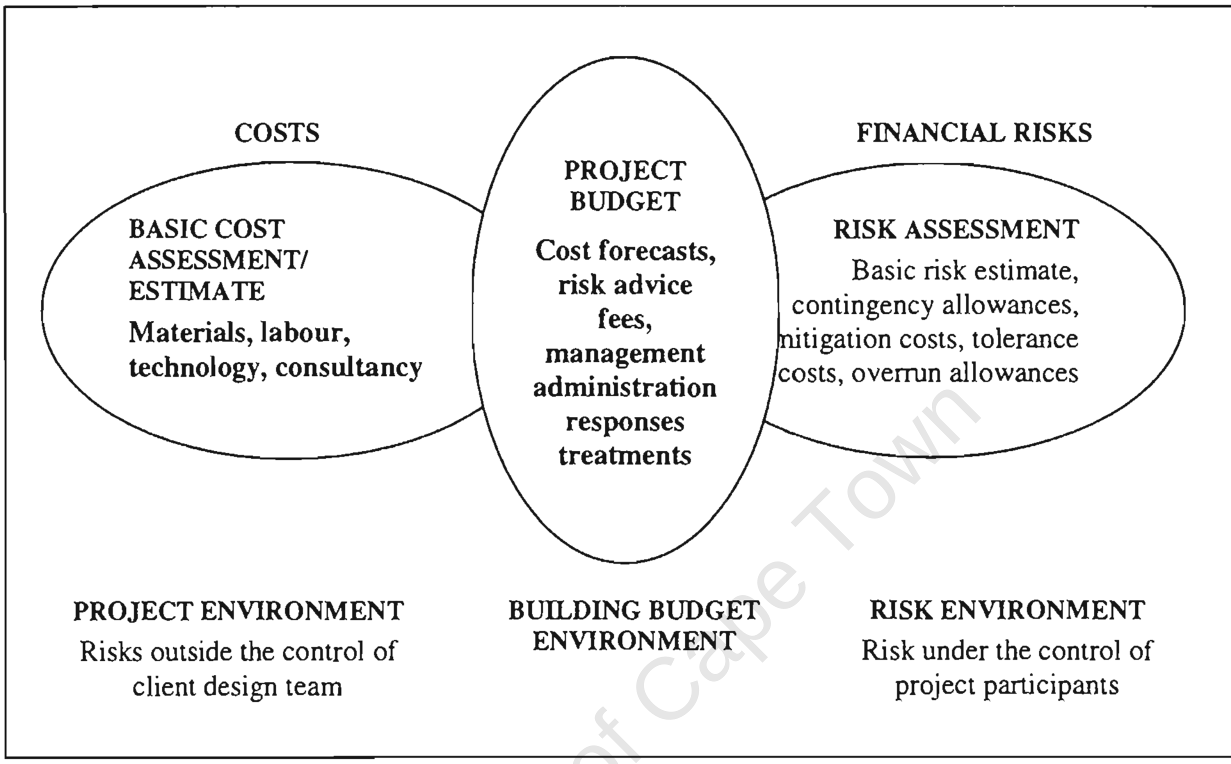

Figure 4.2 Building budget and the risk environment.[4]

Simplifying budget prediction implies a work breakdown structure of building development activities so that they may be assessed and incorporated into budgets (Chapman, 2001; Raftery, 1994a). The breakdown of the description of items and of the measurement used is aimed at providing an effective and consistent exchange of information, but this could present difficulties as the cost and cost breakdown may vary from one organisation to another. Hartman and Jergeas (1997) found that the planning of most projects is based on known facts and historical data, and in the absence of the former, calculated guesses are used (Mak et al., 1998). Hence traditional single-sum allowances are commonly based on known fact and history.

[4] Adapted from Lowe and Whitworth, 1996.

The absence of financial risk indicators in theoretical data influences financial risk management. Budget prediction follows a form dictated by history and experience and is generally based on previous success. Each team member responsible for an activity should have participated in setting the project budget or its financial risk indicators and is thus expected to know the project's estimated cost, the expected completion date, and the required cost inputs.

4.2.6 Risk analysis

The purpose of risk analysis is to quantify the effects of risks identified from a project. Hertz and Thomas (1984) describe risk analysis as the application of methods which aim to develop insights and understanding of the impacts associated with a particular risk in a building development, or a variable in the forecasting of the building cost budget. Some publications, for example the Royal Society Study Group Report (1991) and Cooper and Chapman's (1987) Risk Analysis for Large Projects (1987), describe the concept of risk analysis, which they say is often confused with risk evaluation. Strutt (1993), cited by Frosdick (1997), also expanded the definition of risk analysis to include the evaluation and tolerance of risk. In other words, risk analysis is deemed to be the sum of the processes of risk identification, estimation and evaluation. Chapman (2001) supported Frosdick (1997), regarding the idea of separating risk analysis and risk management in the evaluation of risk indicators.

In this study risk analysis is defined as the process of analysing financial variables which are subject to risk and uncertainty in forecasting the building cost budget (Edwards and Bowen, 1999). This implies that all indicators should be evaluated and assessed and their costs determined for incorporation in the project budget. Diekmann's (1997) findings about risk analysis were matched by those of Lorance and Wendling (2001), although their areas of focus differ on the stage at which the budget should be increased to cover anticipated risks. The authors agreed on the necessity to carry out risk analysis – in order to facilitate budget prediction.

Songer et al. (1997) examined risk analysis for revenue-dependent infrastructure projects in the USA. They found that recent trends in the construction industry indicated changes in procurement methods such as design and build, management contracts, build-operate-transfer (in project finance initiative projects) and design-build-and-maintain. These changes have, they say, introduced complications with traditional techniques of estimating building costs. The new methods require new approaches to budget prediction and cost planning procedures. The increased use of current procurement methods produces higher levels of uncertainty, making it necessary to investigate cost impacts through enhanced pre-project financial planning and control analysis. The findings of Al-Tabtabai and Alex (1998) agreed with those of Songer et al. (1997) that traditional costing techniques risk assessments were limited in their applications and there is therefore a need for risk indicators that are able to represent risks affecting specific projects.

In contrast to Al-Momani's (1996) approach to cost prediction, Songer et al. (1997) adopted enhanced risk quantification techniques rather than using cost prediction models. The enhanced analysis tools include: probability, sensitivity, decision trees, utility theory analysis, and Monte Carlo simulation. Moreover, the appropriate identification of critical project-specific risks allows project participants to avoid, manage or mitigate these risks. Songer et al. (1997) conclude that traditional methods of project analysis are inadequate for dealing with increased risk exposure, and suggest that there is a need for effective risk analysis tools to be developed for early stage cost advice. This is because improved assessment of project risks encourages appropriate determination, mitigation and avoidance of highly uncertain building activities, as well as aiding financial risk management. Lorance and Wendling (2001) and Dawood (1998) concur on a similar risk quantification approach, such as the use of general cost guidelines recommended by Hegazy and Moselhi (1995).

Mak et al. (1998) conducted a study on the effects of using risk analysis in capital cost estimation of contingency allowances in Hong Kong. This is particularly informative on contingency allowances. Using an opinion survey, data was collected from 72 non-participating groups (that is, groups not using estimating risk analysis – non-ERA) and 19 participating ERA groups. Unlike Lorance and Wendling (2001), Mak et al. (1998) adopted a research technique in which building project risks were identified, classified and costed with their uncertainties. Mak et al. (1998) showed that firms using established estimating guides such as ERA (Estimating Risk Analysis) in Hong Kong construction industry reduce unnecessary and exaggerated allowances for risk for public projects risk.

Edwards (2001) and Raftery (1994a) both noted that the existence of personal bias as well as differences in risk perception and risk attitude affected calculations of contingency risk allowances in building budgets. Risk analysis is consistent with the traditional practice of advising clients of likely costs. Mak et al. (1998) conclude that if estimated costs appear to imply absolute certainty then the adverse effects associated with the project have probably not been evaluated adequately. In the same way, Putzer (1995) queried traditional practices in terms of percentage budget allowances, while Thompson and Perry (1992), cited by Mak et al. (1998), pointed out limitations of contingency allowances, saying in particular that the method of their calculation was not transparent. However these researchers supported the use of risk analysis techniques to determine building costs, and the possible use of risk indicators at an early stage as they offer the possibility of developing a budget theory which would facilitate accurate prediction.

4.2.7 Summary of building budget

Stakeholders can expose the client to financial risk in the building budget, despite there being project owners (clients), contractors, architects, engineers and quantity surveyors who all may rely on the certainty of the provided information. A building budget should incorporate all risk impacts and, although some risks may be eliminated, reduced or transferred to appropriate third parties, the cost of such a risk will invariably be passed to the client. Possible exposure to cost budget variability arising from involvement in the building process could be abstracted as a risk indicator from the project information or risk assessment, and added to the cost plan.

Some projects have a high degree of complexity or uncertainty generated by participants and the environment in which the building budgets are prepared. The appropriate identification of critical risks allows project participants to avoid, manage or mitigate risks, using identified project-specific risks, represented as risk indicators. However, such enhanced methods are often affected by a lack of project information in the building budget environment.

4.3 Risk identification and measurement

Given incomplete or insufficient project information at the early project stages, there is a need to aid risk assessment and management in building projects by identifying significant risk indicators. Risk can then be determined and measured according to the information available. This was described in Section 4.2.

This section aims to explore risk indicators as the means of assessing risks in building projects. Once identified, risk indicators can be quantified to aid financial risk management at an early project stage, when budgets are needed to guide project development. The section discusses risk discovery, detection and identification (Section 4.3.1), risk measurement and quantification (Section 4.3.2), probability and severity of occurrence (Section 4.3.3), and ends with a summary of risk identification and measurement (Section 4.3.4).

4.3.1 Risk discovery, detection and identification

Risk identification represents the first step in striving to reduce uncertainty by assessing risk by identifying the frequency and severity of potential problems. Researchers such as Lowe and Whitworth (1996), Raftery (1994a), Flanagan and Norman (1993) and Mak (1992) showed this to be an important step in risk management. In other words, effective management and control measures cannot be set up without first discovering risks. Once discovered, a risk changes from an unknown, and therefore unpredictable, quality of the project to a more definitive attribute (Flanagan and Norman, 1993). Papageorge (1988) observed that frequently risks are detected only when they manifest themselves as problems through risk indicators.

Accumulated knowledge on risk, risk detection and discovery implies risk identification. The Royal Society Study Group Report (1991) argues that risk identification comprises the detection and discovery of possible adverse outcomes and opportunities where the project might save on its predicted cost. Even after this they added risk evaluation to complete the process of risk identification. The magnitude of the consequences and opportunities plus the probability of those outcomes and opportunity savings needs to be costed. Firstly, notwithstanding known risk detection and discovery procedures, risk identification has not received adequate research attention (Raftery, 1994a). Secondly, although risk identification has been mentioned and addressed in some risk management literature, for example Bajaj et al. (1997) and Chapman (2001), risk indicators, or the absence of them, continue to manifest themselves as financial risk impacts, causing disparities between the original budget and the final building cost.

Bajaj et al. (1997) used a survey questionnaire to examine the approaches to risk identification of nineteen construction contractors in New South Wales, Australia. According to them, risk identification, assessment and evaluation at the estimating stage, should be detailed to benefit the management process. Nevertheless, the most frequently used method of risk identification remained the top-down approach, which led to guesswork in terms of contingency allowances for risk (Mak et al., 1998). Bajaj et al. (1997) concluded that risks are unique and so detection should cover the whole spectrum of risks that might be present from the start of building development to completion.

If all the uncertainties relating to a particular project have been detected, subsequent evaluation and assessment could be completed using identified indicators for the significant risks. Moreover, risk indicators are representative, so lack of information and inadequate time allocation are deemed not to affect them. Urgency and time limitation are the biggest budget preparation constraints, as well as reliance on historical information or any similar experience of a person or organisation (Akintoye and Fitzgerald, 2000). However, researchers such as Songer et al. (1997), Samid (1996) and Loosemore (1995) established that the risk detection process, if followed meticulously, improves the accuracy of estimates and thereafter the budget prediction. The findings of Uher (1996) concur on the importance of identifying building risks for accurate risk analysis. Consequently risk indicators, once identified, can become management issues as they can be quantified and managed.

4.3.2 Measurement and quantification

Forecasting is the basis of all planning, budget preparation, risk management and cost control (Uppal, 2001; Cortes-Rello and Golshani, 1990). In addition, for risk quantification, and for assessment and cost planning, the techniques of cost forecasting are needed to initiate the risk measurement and quantification process. Cost forecasting is aimed at predicting the total anticipated expenditure required to complete a particular building project (Uher, 1996). The starting point of a forecast is the measurement and quantification of work, followed by the pricing of work involved. While measurement is viewed as a mechanical process, price forecasting is inherently probabilistic, thus introducing the concept of probability into budget prediction management, cost planning and control (Uher, 1996).

Uher (1996) used a budget measurement model for probabilistic cost forecasting, while Bowen and Edwards (1985) examined uncertainty and incomplete information in the evaluation of building projects. Deterministic methods of price forecasting and viability analysis for construction projects were found to be inadequate in quantifying the uncertainty of an incomplete information base for a building project.

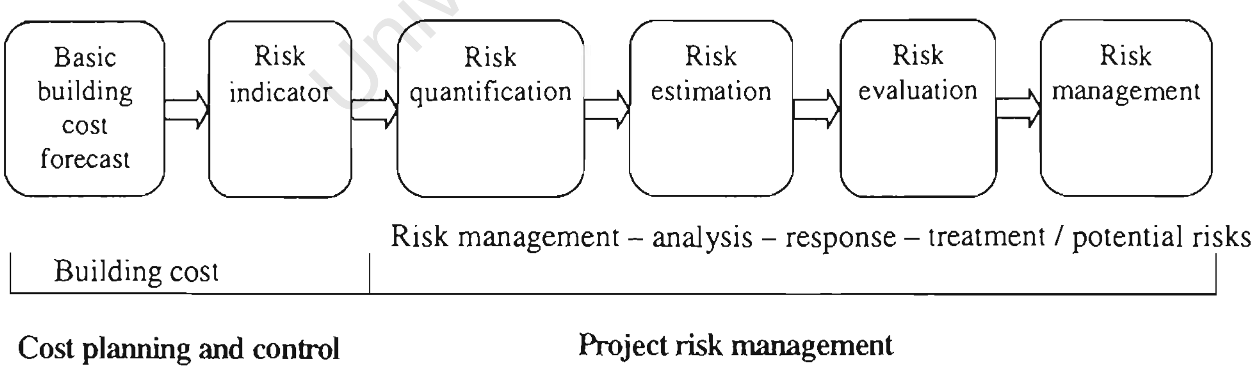

Figure 4.3 Systematic approach to assessing (measuring/quantifying) risk indicators [5]

[5] Adapted from Flanagan and Norman (1993).

Bowen and Edwards (1985) conclude that developers and other investors rely on the professional building cost consultant to initiate projects, based on the measurement and quantification provided, but this approach could eventually lead to errors in investment or cost advice when clients are supplied with a single-sum deterministic budget. The findings of Tah and Carr (2000) match those of Bowen and Edwards (1985) in saying that other methods of risk assessment and measurement offer the possibility of using defined risk indicators to facilitate the formulation of a budget.

Measurement and quantification techniques should be capable of permitting explicit treatment of uncertain or incomplete information through enhanced risk analysis methods. Probabilistic methodologies such as sensitivity analysis, probability analysis, decision trees, utility theory and expert systems and, in particular, Monte Carlo simulation, are recommended by Songer et al. (1997), as they permit explicit treatment of risk evaluation. In spite of uncertainty in information, and in the quantification of building costs, a financial risk indicator needs to be measured and quantified to determine its effect on building cost forecasts. Despite their differences in approach to risk management functions and decision-making, the Figure 4.3 represents – for all these authors – a flow of information from project start to completion.

Figure 4.3 indicates a systematic approach of identifying, quantifying and evaluating risks. It shows the link between cost planning, cost control and risk management through the forecasting of building costs and the building risk management functions.

Notwithstanding the lack of integration between cost planning and risk management, Diekmann et al. (1988) concentrate on the concepts of risk management in capital projects while Cooper and Chapman (1987) focus on identification of risk and risk analysis for large projects. All these authors conclude that risk identification is the most important element of risk planning. The estimation of the likelihood (probability) of occurrence and the consequences associated with risky events, as well as the magnitude of such consequences, make up the complete process of budget prediction.

Diekmann et al. (1988) argue that risk measurement is a process whereby uncertain measures of inputs to a building project are transformed into far more certain quantities and therefore give a far more precise cost budget estimate. Quantifying expert opinion through frequency data as well as by using subjective information enables the professional building cost consultant to advise the client more accurately on the budget. The findings of Macsporran and Tucker (1996) and Jeffery (1996) support Diekmann et al. (1988) with regard to systematic measurement, quantification and assessment, as well as the possibility of better budget prediction using risk indicators.

Hatush and Skitmore (1997) investigated pre-qualification and bid evaluation in the pre-tender process, using the Project Evaluation and Review Technique (PERT) approach as a means of measuring and quantifying the uncertainty and/or imprecision associated with financial forecasting building costs. They use this quantitative technique in order to combine the cost data with the project goals. The pre-qualification criteria of financial capacity/expenditure/cost input into the project are indirect measures of the likely quantification of the monetary resources that are required to achieve the project cost objective. They say that the cost objective should not only be effective in meeting the final project cost, it should also be closer to the original budget cost. In other words, the effect of the predominant costs, and hence of risk indicators, needs to be known.

Hatush and Skitmore (1997) further propose a process of compiling risk cost levels. Using risk analysis with sensitivity methods, this provides a direct indication of the likelihood of a project meeting its cost objectives. They conclude that the PERT model, incorporating multiple risk ratings, permits uncertainty in project data to be evaluated qualitatively. They point out that the information available at the early project development stage is often inadequate, and all that can be observed are risk indicators, which could be used for cost planning at that stage. Despite the risk ordering solution developed by Hatush and Skitmore (1997), Liu and Walker (1998) pointed out the need for risk indicators in their study of the evaluation of project outcomes and budget prediction.

4.3.3 Probability and severity of building risk

Pedwell et al. (1998) completed a study on project capital, cost risks and contracting strategies, using a quantitative matrix survey and interviews with 30 industrial practitioners, based on their experience and reputation. They found that an owner's influence over a project is greatest in the early stages. The severity of a risk impact and its probable effect on cost, as well as the risk associated with the forecasting of building cost, are all considered in the cost outcomes. Although severity quantification risk may be small, evaluation is carried out initially through front-end cost planning, brainstorming and discussions to determine the impacts and their consequences. Budget quantification, through indicators of risk probability and severity, also offer the possibility of developing a general budget prediction theory.

The impact-determining process is successful when there is co-ordination and motivation to ascertain risks by using bottom-up techniques from the project organisation and from other participants. Bajaj et al. (1997) proposed that these techniques led to a detailed assessment of risk and of the severity of risks. The project risks are then thought through in fine detail by the building team, from outset to project completion, giving insight into risk occurrences (Pedwell et al., 1998; Songer et al., 1997). Moreover, the cause of budget failures is usually a lack of consideration of risks, knowledge and information on the probability of event occurrences and the likely severity of their effect on the set budget. Financial risks in building are rooted in poor front-end planning in the early stages of a project (Pedwell et al., 1998). Thus there is a need to discover risk indicators, so as to enhance risk assessment, since the absence of financial risk information at an early project development stage can cause ineffective capital cost quantification. Examples are depicted in Figure 4.4, which shows the basic risk estimates commonly used in building budgets.

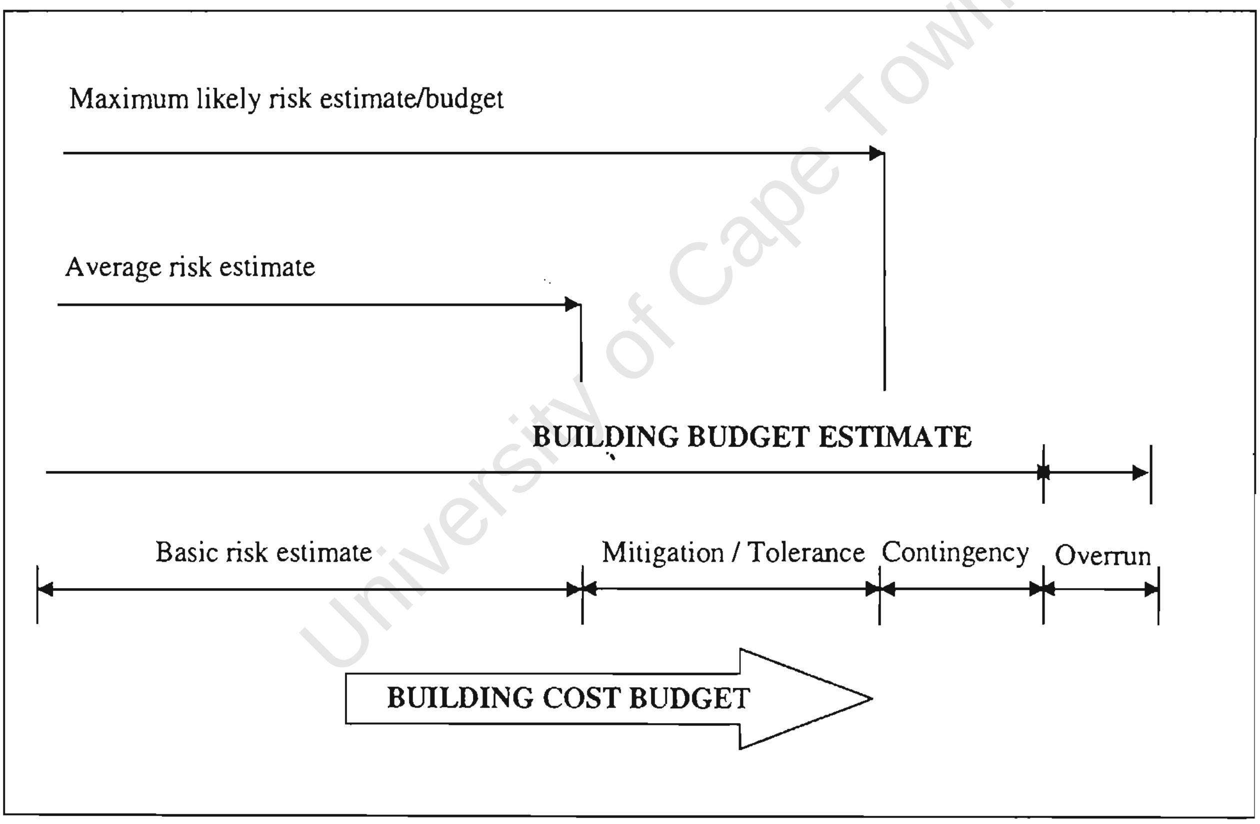

Figure 4.4 Probability occurrence distribution of risk versus predicted cost severity[6]

Figure 4.4 shows the relationship between the probabilities of an event happening together with its assessment phases. If a risk has a high probability of occurring then it is likely that its severity is

[6] Adapted from Lowe and Whitworth, 1996.

highly rated and the effect might be taken into account during budget prediction at early project stages. Financial risk assessment relies on the identification and probability of risk occurrence, hence the proposal to develop a budget prediction theory based on this occurrence and the likely severity of its effect on the building budget.

4.3.4 Summary of risk identification and measurement

This section has described risk knowledge as the basis for identifying and eventually treating potential risks indicators. Risk identification represents the first step in striving to reduce uncertainty and the determination of potential risk indicators, and the method of risk quantification and evaluation is equally important.

Poor budgets are rooted in inadequate front-end planning at the early stage when the owner's influence over a project is greatest. This is also the stage at which the probability of an event happening can most easily be controlled.

Lack of information and time represent major constraints in budget prediction. Experience in risk management is an essential skill for cost planning but projects are not usually executed under similar conditions and as such project risks change from project to project. Over reliance on historical information and previous experiences of a person or organisation are also constraints which hinder accurate budget prediction. To eliminate some of these constraints, an appropriate approach is to identify potential and adverse events through the detection and discovery of risk events or to represent risk patterns in a specific project with identified risk.

4.4 Management of risk drivers

The situation described in Section 4.3 justifies identifying and determining all risk drivers, to aid risk management. This section aims to identify events that cause risk factors in building projects by discussing managing risks (Section 4.4.1), risk profiling and clusters (Section 4.4.2), risk significance, ranking and prioritisation (Section 4.4.3), broad risk entities and subsets of risk (Section 4.4.4), and ends with a summary of the management of risk drivers. The identified risk sources or factors will validate the research design described in Chapter 5 and, in particular, will examine the risk variables in building projects at an early stage of project development.

4.4.1 Managing risks

Managing risk involves minimising, controlling and implementing risk management plans and strategies (Kartam and Kartam, 2001; Kim and Bajaj, 2000). Authors, for example Chapman (2001), Edwards and Bowen (1998) and Hayes et al. (1986), categorised risks according to their sources. Categorisation is important in managing risk effectively but is also needed for assessing and evaluating the most significant risks. In that way risk management is simplified before risk assessment is incorporated in the building budget.

In an attempt to identify suitable management strategies, certain publications, such as RAMP (1998), use live case-based management. The risk analysis in such publications considered manifestations of financial risk events and outcomes in order to detect and direct responses and subsequent management. Unfortunately, in the absence of risk indicators in these categories of risk and with little or no prior knowledge on project risk, effective prediction of the budget was not possible (Lampel, 2001).

Conversely, the professional building cost consultant uses prior knowledge and experience of known risk drivers to manage risks. In other words, he or she manages risks that offer the possibility of developing findings that could result in accurate budgets. Morrison (1983) stated that estimates would not be improved until quantity surveyors moved from being passive to proactive participants. This requires foresight, knowledge and experience of possible indicators of potential building risk. Similarly, the findings of Samid (1996) agreed with Loosemore (1993), who advocated the qualitative presentation of risk knowledge to promote the proactive management of risk. Budget prediction and management also require rich data, which can be proactively obtained from case-based studies. Samid (1996) recommends the use of an abstract management strategy. This resembles the opinions of Kartam and Kartam (2001), particularly regarding the management of finances by using possible risk indicators, with information gathered from data-rich case studies.

If the professional building cost consultant is able to recall past cases he or she can apply case-based management, using the history of a similar previous project, which was appropriate for testing alternative management strategies. According to Edwards and Bowen (1999), the distinctions between the various risks affecting a project, and therefore their management, cannot be absolute without a complete identification of all such risks. Some risk indicators are likely to remain unnoticed and unidentified as projects are unique, and also different groups perceive risk management differently regarding risk sources, causes, events and consequences. Liu and Walker

(1998) mention previous case exploration and hindsight as being important in recalling previous case histories and their risk indicators.

Kim and Bajaj (2000), Loosemore (1995) and Chicken (1994) all suggest that early identification could aid budget prediction by means of reactive management and the assessment of significant risks from projects. Risk identification through the direct and impartial observation of major projects would classify risks in accordance with company risk procedures, to satisfy the project and participant's requirements. However, the absence of risk indicators in reactive management renders budget prediction ineffective under uncertain building conditions.

Notwithstanding the difficulties in dealing reactively with building management structures, Chapman (2001) attempts interactive management through a project risk management programme. This was aimed at providing a decisive competitive advantage to building sponsors who wished to protect themselves from unexpected events and to gain expertise in cost risk, particularly in the assessment of construction design management. Chapman (2001) places further emphasis on managing the risk phase and is concerned with monitoring the progress of the project and its associated risk management plan. He concludes that managing risk requires an understanding of the characteristics of the risk occurrence process. In addition, he suggests that risks have distinctive characteristics and that their interrelationships can be described in terms of whether they are 'in series or in parallel' when managing selected risk indicators.

White and Fortune (2002) designed an opinion survey to capture the real-world experience in a case-based action management with people active in project management. Each respondent (project manager) was asked to identify factors that he regarded as critical to the project. The management success rates were remarkably high (41%), based on the survey finding of selected risks. Action management identifies risk indicators in advance for implementation into budget prediction. Therefore, prior judgement of events and effects seemed an appropriate method of risk management through action involving case-based risk prioritisation. White and Fortune (2002) concurred with Chapman (2001) on the need for effective risk identification if action management of risk management is to be improved in building projects.

4.4.2 Risk profiles and clusters

Risk profiles aid quantification, assessment and management (Edwards, 2001). In addition to that, risk profiles indicate relationships, similarities and characteristics from the same source or outcome, so that they are suitable for representing outcomes and other causal effects, facilitating the identification of appropriate management responses (Chapman, 2001). In the same way, risks grouped into clusters of similarities or relationships are more readily understood and therefore more effectively catered for in the budget (Kendall, 1988).

Researchers, for example Medley (1996), have identified risk indicators according to their region of operation, especially for global projects, documenting them for purposes of risk allocation and eventual evaluation during tendering. Medley's (1996) clusters include physical risks, acts of God, impracticability or impossibility, latent site conditions, quality variations, site access, weather, capability-related risks and defective work, to categorise risks and thus risk clusters. Medley's (1996) approach differs from that of Zack (1996), who adopts a contractual approach to risk profiling; that is using the General Conditions of the Construction Contract to cluster building risks. Risk identification lists by some authors, such as Ward (1999), also disagreed with Zack's interpretations (1996) of risk profile and clusters, as well as risk indicators generated from risk sources or factor clusters. Zack's summary (1996) is based on five basic classes of risk sources: contractual, client/professional team, estimating, project and external risks.

Jaafari (2001) worked with a source of risk within the life cycle framework that fell within 'Life Cycle Objective Functions' (LCOF). His article introduces LCOF clusters that include promotion risk, market risk, political risk, technical risk, financing risk, environmental risk, cost estimate risk, schedule risk, operating risk, organisational risk, and *force majeure*. Identifying risk indicators as a source of cost impact could be contentious and subjective, but profiles and clusters based on similar risk characteristics can offer the possibility of developing accurate budgets – when used with risk categories.

Jaafari's (2001) risk clusters are almost as systematic as the RAMP (1998) clusters, which use risk matrices to classify risk sources. The RAMP (1998) clusters are: political, business, economic, project, natural and financial. However the different sources of risks explored by researchers, such as Chan and Kumaraswamy (1995), are not exhaustive and there may be times when sources of risk cannot be generalised.

Notwithstanding the lack of agreement on risk profiles and clusters related to a specific objective, it is evident that risk indicators can be adapted from risk sources to aid financial risk management (RAMP, 1998). The findings of Liu and Walker (1998) and Chan and Kumaraswamy (1995) agree on the apparent need for setting risk clusters and risk profiles with similar characteristics. These are likely to be related and therefore offer the possibility of developing a budget theory.

Figure 4.5 illustrates the clustering of risk sources in a breakdown structure of financial risk indicators, identified through their sources (Chapman, 2001).

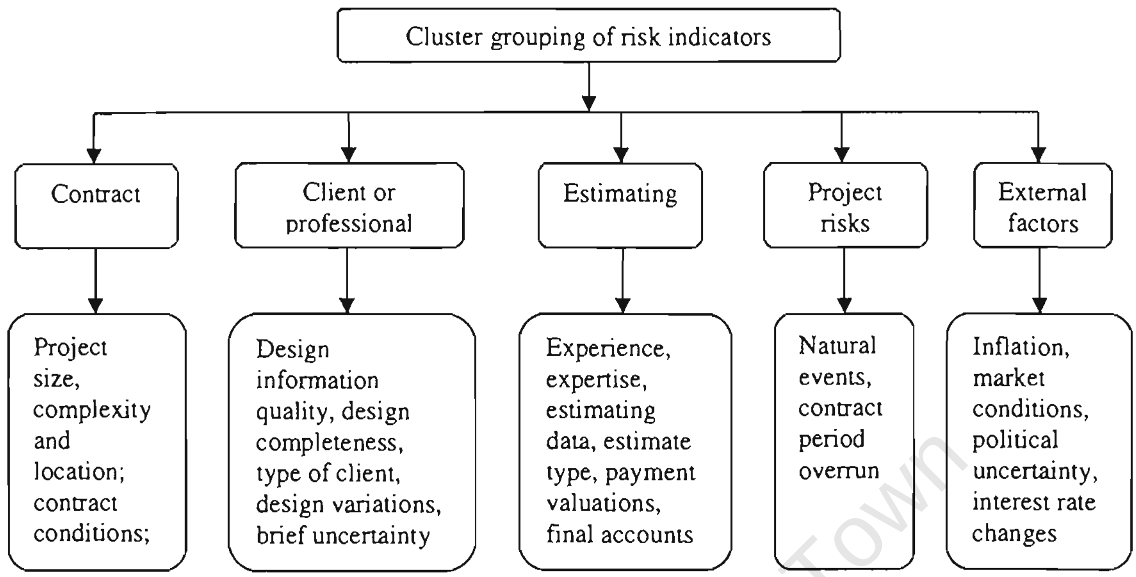

Figure 4.5 Clustering of sources of financial risk indicators[7]

Jaafari (2001), as well as Edwards and Bowen (1999, 1998), identify twelve risk sources based on two clusters. Their risk profiles originate from natural and human sources. Jaafari (2001) found that the source of an adverse event could be the best primary denominator, as all technological risks stem from some form of human activity. Edwards and Bowen (1999) conclude that experience and knowledge of risk sources is important to budget preparation. They clustered risks in accordance with their source types, such as the weather system, the geological system, economics, political, financial, technical and management risks. Indeed, identifying risk by source allows for early exploration by participants and may lead to discussions and the adoption of common risk management strategies, thus providing a clear focus for the treatment of potential risks, as depicted in Figure 4.5.

[7] Adapted from Chapman, 2001 and Diekmann et al. 1988.

4.4.3 Risk significance, ranking and prioritisation

Project risk management literature (for example Baccarini and Archer, 2001) commonly describes the need to rank and prioritise risks, but as the ranking approach has not been defined clearly there is a need to explore risk indicators to further improve on the establishing of significant contributors to cost impacts in building budgets.

Risk events may be classified as significant or minor, depending on the effect and cost impact of the event. The likelihood of a risk occurring, as well as its magnitude in cost terms, is important to risk management (Liu and Walker, 1998). The most important risks are judged in accordance with a cost scale and are given first priority in quantification. The setting of risk priority in handling risks in budget prediction remains an option in selecting suitable risk indicators that offers the possibility of developing a budget prediction theory (Baccarini and Archer, 2001).

Ward (1999) completed a study on assessing and managing important risks and found that a common problem in the project risk management process is the need to determine the relative significance of different risks. This significance should guide subsequent risk management efforts to ensure that they remain effective at the early building stage. The identification of risks may be approached through the use of past experience and the shared of knowledge of risk indicators.

Despite the simplicity and convenience of ranking risks in accordance with their cost importance, Ward (1999) noted that there are shortcomings in the priority ranking approach, such as:

- individual risk drivers that may not be described in sufficient detail to avoid ambiguity and misunderstanding;
- inter-dependencies between risks that are not readily revealed; and
- previous risk experience / exposures and knowledge that provide only limited guidance on the importance of individual risks drivers.

The time taken to undertake investigations into risk is limited and hence the need to determine significant risks and to exclude minor ones during cost prediction. Risk significance is established through evaluating the cost impact of the risk and the probability of its occurring. Other factors, such as the cost of likely risk exposures, are considered in risk ranking and Ward (1999) noted that the given time is usually inadequate for extensive risk analysis, thus confirming the need for risk indicators.

The lack of evaluation time shows the need for simplifying risk assessment and for effective risk management. For example, Baccarini and Archer (2001) recommend using simple procedures, such as ranking risks in terms of identification, probability of occurrence and cost impact. Chapman (2001) and Ward (1999) agree on the usefulness of ranking of project risks in accordance with their significance. Ranking of risk indicates the cost significance of all risk indicators and has the advantage of being less demanding in terms of time and information. In this way risk indicators can be more readily understood and thereafter effectively assessed (Elkington and Smallman, 2002).

4.4.4 Broad risk entities and subsets of risk

Bearing in mind that information on project opportunities and outcomes might not be known, specified or determined at the inception of a project, the professional building cost consultant may rely on broad entities or risk subsets. Similar risks can be quantified, assessed and managed with similar approaches or methods for the purposes of budget prediction (Samid, 1996). The consultant should carry out an analysis in order to explore broad-based risk sources and factors for parameters that identify groups of risk subsets.

Other researchers such as Chan and Kumaraswamy (1995) explore risk subsets and the identification of risks through management similarities, characteristics and relationships such as government building risks, private building risks and civil engineering works. Miller and Lessard (2001) classify risk from management perspectives such as productivity and post-contractual relationships. The risk sources and factors from management problems form a class of broad risk entities relating to the management of risks.

The professional building cost consultant must identify the risk entity, based on relationships and similarities in risk character, in order to produce a meaningful cost budget (Samid, 1996). Samid's classification of risk entities differs from the typical influence diagram identified by Edwards (2001). The risk sources and factors did not incorporate all the effects of multiple uncertainties when establishing budgets and schedules. The broad risk entities identified are used to represent the likely risk indicators, through the exploration of broad entities of relationships and similarities, as depicted in Figure 4.5.

Although factors were not specified in the early stages of project development, the approach to broad risk subsets made by Rutgers and Haley (1996) differs from that of Diekmann (1997) regarding the comprehensive approach to budget. Rutgers and Haley (1996) explore risk sources with similar characteristics, and identify risk sources to align the client's objective subset values for their investment. They conclude that developing risk subsets and categories should be based on construction characteristics rather than any other tool. Managing risk with subsets such as development or sponsor risk, contractor risk, lender risk, and host government or local authority risks, would be appropriate for identification of such broad subsets. Moreover, subset groupings should apply to indicators to ease risk exploration and offer broad entities of similar subsets with the possibility of developing better budget prediction.

Medley (1996) approached risk indicators under risk entities based on life cycle cost relationships and characteristics. In addition to the list he adapted in the context of the life cycle perspective, Medley (1996) differentiated between external and internal risk sources. He then defined external risk factors as political, economic, social, technological and financial systems, while internal factors were location, management policies and types of enterprises. Medley (1996) differed from Jaafari (2001) in his emphasis on the identification of political, technical and financial risk variables. Other consultants have not detailed and clarified risk entities in relation to their broad similarities as Medley (1996) and Diekmann et al. (1988) do, and thus have not offered an opportunity to develop a budget theory.

Broad risk entities have been devised for different purposes, but these are likely to be incomplete and therefore inadequate for budget prediction (Edwards and Bowen, 1999). Predicting the budget with broad risk entities and subsequent cost planning is an effective means of dealing with risks in building costs (Uher, 1996). Given the limited prediction and prevention capability of the risk manager, unexpected problems and risk opportunities are inevitable on building projects (Loosemore, 1995). Tackling the unexpected requires proactive management so that the potential benefits of opportunities and possible costs savings are maximised. Recognising risks, broad entities and their source relationships and similarities is another means of exploring the magnitude of risk and determining the factors that generate cost overruns. Developing relationships can also be used in cost planning and in the budgeting of building costs (Al-Momani, 1996).

4.4.5 Summary of management of risk drivers

This section has described the identification system of significant risks. Once these have been identified, management efforts should focus on their quantification, assessment and management.

Categorising risk by sources helps to assess risk thus making risk management easier. The trend in the industry is to use risk clusters by source in order to identify risks early enough and to recommend action after their quantification and assessment.

Limited information and time exist to analyse all risk extensively and manage them effectively, and thus the ranking of risks in terms of their probability of occurrence, and identifying sources of risk in terms of risk indicators, are therefore essential for simplifying risk management. Risk indicators will then be more readily understood and can be assessed thereafter.

4.5 Treatment of potential risks

The discussion in Section 4.4 explored the management of risk drivers as they affect potential risks and, eventually, budget prediction. This section discusses the treatment of potential risk in the building budget environment and covers the identification of potential risks (Section 4.5.1), the treatment of potential risks (Section 4.5.2), communication of and responses to potential risks (Section 4.5.3), and ends with a summary of the treatment of potential risks (Section 4.5.4). The investigation into the treatment of potential risks supports the hypothesis stated in Chapter 1 and helps to focus on the research design outlined in the next chapter.

4.5.1 Identification of potential risks

The literature, for example Elkington and Smallman (2002), maintains that risk management consists of risk identification, the determination of potential risks, and risk estimation, to determine the importance of each risk, based on the likelihood of its occurring, and its probable impact. The risk management process helps project managers to decide whether or not the level of risk is acceptable and, if not, what the appropriate action is. Elkington and Smallman (2002) conclude that risk identification is largely informal and that it is important to evaluate and assess the most appropriate responses in order to determine potential risks at the early development stages. As a result, risk indicators should be determined and assessed at the early project development stage, since they represent potential risks.

According to Pedwell et al. (1998), project inception is the point at which cost planning and control procedures become effective in project management. They recommend that, if risk avoidance is not feasible, attention be given to reducing the frequency and size of the risks. They also recommend transferring all, or a portion of, the remaining risks to a third party. Flanagan and Stevens (1990) on the other hand, argue that at the final stage of identification, the magnitude of those risks that cannot be avoided, transferred or reduced, should be assessed and compared to the client's capacity or disposition to absorb the potential overrun or delay. Potential cost overrun is an indicator of a future problem that could affect the client's capacity to build. The absence of risk indicators in the client's potential building capacity affects the forecasting ability of the consultant. White and Fortune (2002) propose similar ideas on assessment using risk indicators when a risk is likely to occur, although their areas of focus are not the same as those of Pedwell et al. (1998). These differences between the various authors may be the reason why risk indicator findings have not been generalised.

Chapman and Ward (1997) state that risk identification is both important and difficult in terms of determining potential risk likelihood, and that creativity and imagination may be needed. Subsequently they appear to have considered the assessment of the likelihood of a risk occurring. However, risk identification as a process is technical and requires the input from other participants – like architects and engineers – through creativity and imaginative approaches such as discussions, interviews, brainstorming or the use of a risk profile.

Some authors, for example, Bajaj et al. (1997), Flanagan and Norman (1993), and Hayes et al. (1986), agree on the purpose of identifying potential risks, namely project knowledge acquisition. Subsequent analysis of risk is to enable the professional building cost consultant to make a considered financial response in advance of the potential problem occurring. However, other researchers including Lowe and Whitworth (1996), claim that building cost consultants have generally gained a poor reputation for responding to risk because many projects have failed to meet deadlines and target costs. There is thus a need to determine potential risk indicators.

Notwithstanding poor risk quantification and unknown potential risks, the findings of Elkington and Smallman (2002), Chapman and Ward (1997), and Hayes et al. (1986) support the risk identification approach, and suggest the use of potential risk probabilities to assess cost impacts. The absence of risk indicators for determining the potential likelihood of risk, particularly when responding to building cost forecasts, has led professional building cost consultants to produce ineffective budgets that do not facilitate the development of accurate budget theories.

4.5.2 Treatment of future risks

Every building activity has its own inherent risk that cannot be assessed with certainty but risk indicators may simplify risk assessment process (Ock, 1996). Ock (1996) believes that the treatment of potential risks depends on identification and quantification. Additional quantification of cost impacts under uncertainty can be applied more suitably through their descriptive terms (qualitative approach) than with traditional methods (Ock, 1996).

The objectives of any treatment of potential risks should be based on identification of the risk sources that prompted it in the first place. It should include the integration of all risks generated by that source that affect the project cost objectives. However, risk issues associated with cost estimates are seldom explicitly quantified when building costs are forecast. Ock (1996) points out that the treatment of future risks and their consequences is likely to be based on historical records, published data, experience and the opinions of experts. Such findings could be generalised by means of representative risk indicators.

Relevant historical records on risk consequences and the opinions of experts may of course vary and, in addition, they may not be easily available for direct use with project details. Furthermore, risk treatment should depend on the identification of potential risk and the project cost objective. As a result, the absence of potential risk indicators in project information and historical records can cause ineffective budget prediction (Lampel, 2001). In a situation where project information lacks historical references, the treatment of potential risks may be approached using relevant past records and expert opinions or such extreme scenarios as:

a) Modelling cost estimating approaches in such a way that risks are explicitly identified and incorporated into cost plans (Al-Hajj and Horner, 1998; Uher, 1996; Ranasinghe, 1996; Al-Momani, 1996).

b) Direct analysis of the linguistic factors that can be assessed using the (albeit) imprecise, ill-defined and vague description of building events to be incorporated into risk allowances (Tah and Carr, 2000; Kangari and Riggs, 1989).

c) Risk assessment can be treated as a quantitative factor in risk evaluation. This can causes ineffective budget prediction, since critical information on risk allowances is not given adequate cost cover – as shown in Figure 4.6.

Figure 4.6 illustrates the process of arriving at a treatment of potential risks in risk management functions. Risk management on its own is limited in terms of describing cost impacts and should be expanded to incorporate other areas of incomplete knowledge, such as linguistic terms for describing risk, cost planning and control. The approach adopted in Figure 4.6 systematically incorporates incomplete knowledge from abstracted risk indicators, using the building information provided as well as historical information derived from knowledge and experience of risk sources, factors, risk clusters and other identification tools (Pender, 2001; Diekmann et al., 1988).

Figures 4.3 and 4.6 illustrate the systematic treatment of risk indicators in a conceptual model. Potential risk indicators are absent in risk management functions. The specific purpose of Figure 4.6 is to highlight that the incorporation of risk into budget prediction typically depends on risk factors, including the probabilities of events and cost impacts. It shows that different risks apply in different phases of the risk management process, so there is need to integrate risk management practices into cost planning procedures (Diekmann et al., 1988).

The treatment of potential risk should be initiated soon after the risk analysis and risk management strategies have been set (Miller and Lessard, 2001). Risk identification and quantification and management strategies should be analysed to find the most suitable among the risk responses. The response to risk that best fits into the project objectives may, however, be difficult to identify, thus the necessity for an early investigation using risk indicators.

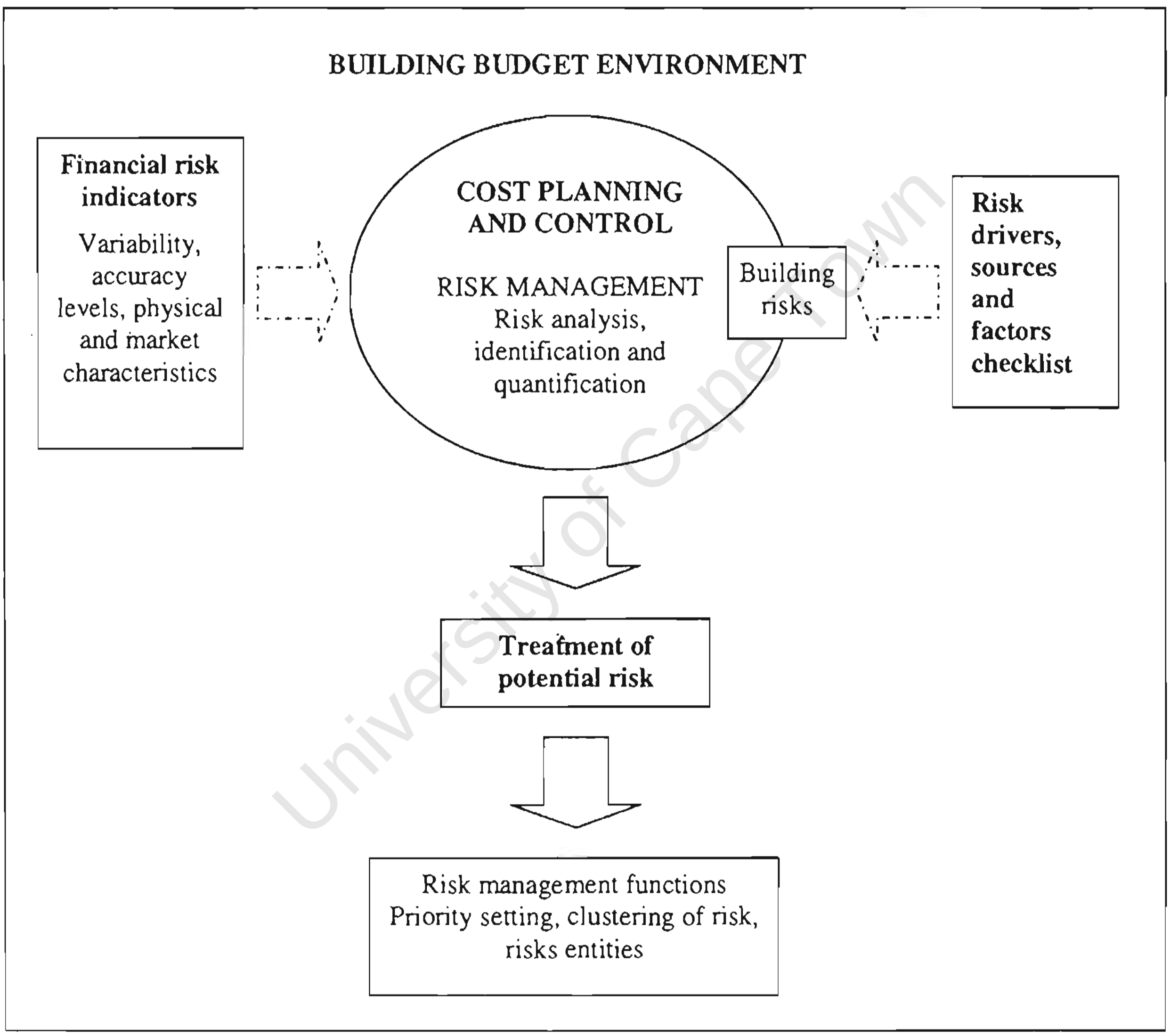

Figure 4.6 Conceptual model of potential risk indicator treatment and risk management functions [8]

[8] Adapted from Edwards (2001).

Edwards (2001) maintains that the treatment of potential risks should be geared towards meeting the cost objective of the project through specific risk response, but that may require a more in-depth analysis. The difficulties of choosing the appropriate treatment of potential risks are rooted in financial commitment, as they always carry some risks that can neither be eliminated nor transferred (Diekmann et al., 1988). To treat potential risk, the source and characteristics of the problem must be established, and Figure 4.6 illustrates the process of identifying the problem to complement cost planning and control procedures.

Ward (1999) proposes compiling a risk treatment soon after project inception and briefing. Project cost should include a summary evaluation of each risk, to indicate its relative size. The Project Risk Register (PRR) distinguishes between acceptably quantifiable risks as well as other risks that stem from a fundamental lack of information and prior risk knowledge (Ward, 1999). Potential risk treatment and directional flow should therefore identify those risks where probabilistic quantification and treatment are hampered by a lack of facilities, or by lack of data concerning known recorded actions that offer possibilities of developing a budget prediction theory

Floricel and Miller (2001) and Miller and Lessard (2001) recommend a strategy framework for risk response control through managerial approaches to risk indicators. The market's financial risk inputs depend on prior risk management designed to control risk drivers. If a building project is to be effective, it should focus on front-end issues (as well as on risk control and mitigating management approaches for the future) (Medley, 1996). Risk, once identified, assessed and evaluated, may be accepted, rejected or reassessed further to determine its status (Pender, 2001). The opportunity for avoiding risks, and the early determination of risk indicators aids risk responses and control. Miller and Lessard (2001) suggest that sponsors of projects could strategise the treatment of potential risks if they are anticipated in advance and influence outcomes by identifying risk drivers and risk indicators.

4.5.3 Communication of risks and responses to potential risks

Effective communication has been a constraint in risk management (Edwards, 2001) and has been highlighted in cost planning and control by Bowen (1993) and also, in reactive management, by Loosemore (1995). Hence there is a need for investigating the process by which building participants and organisations communicate unexpected problems in building. In his study, Loosemore (1995) used site diaries, semi-structured interviews and non-participant observation to minimise the communication biases that could arise from the use of only one technique in management research, and to generate data that provided for a wider representation of the population. Even then he was exploring communication barriers to reactive management alone. He found that the predictive and preventative capabilities in risk communication in building projects are limited, so that unexpected problems and opportunities are inevitable.

Existing communication practice largely reflects uncooperative, differentiated, temporary organisations which lack a collective responsibility for dealing with problems as they arise (Loosemore, 1995). Atkinson (1998) and Bowen (1993) both conclude that temporary management structures are obstacles to effective communication in building projects, leading to ineffective cost prediction. Edwards (2001) believes that the failure of the industry to prevent or plan for its problems could manifest itself as a financial risk but it is assumed that parties will in fact communicate. If the adopted mechanism of communication is ineffective, problems will persist in the communication of risk indicators.

Baker et al. (1999) reports that one of the major constituents of successful risk control is the communication of an appropriate client budget risk response. Their results were ascertained through a survey of over 100 companies, using a survey questionnaire. They suggested that risk evaluation should be carried out by individuals and by groups. The responses advocated by Baker et al. (1999) include risk transfer, risk retention, risk reduction and risk elimination. Elkington and Smallman (2002) agreed with them about the need to find an appropriate risk response. Management response options to risks—include prevention, reduction, transfer and contingency actions that offer possibilities of developing a budget theory.

Baker et al. (1999) conclude that the construction industry concentrates on the direct reduction of financial impacts for risk reduction, although other industries attempt a management approach in responding to risks. Al-Tabtabai and Alex (1998) support this opinion. Ultimately, unless risk indicators are determined and responded to, financial risk exposures will remain a problem in the control of building risk.

4.5.4 Summary of treatment of potential risks

This section has examined the treatment of potential risks through a project risk profile, and by creating risk clusters and broad risk entities. It was found that risk responses are grouped according to the relationships and similarities that affect the risks being treated.

Risks that cannot be avoided, transferred or reduced should be assessed to establish whether the client has the capacity or disposition to absorb the potential cost overrun that might result.

Risk priorities, clusters and broad entities should distinguish between acceptably quantifiable risks and other risks, which stem from a fundamental lack of knowledge.

The treatment of potential risks will depend on their probability of occurrence and potential severity, as well as on available project knowledge.

4.6 Chapter summary

This chapter has explored the budget environment for building projects, the identification of risk indicators, risk drivers and the treatment of potential risk indicators.

- Building costs are derived from plans submitted to the cost planner but other costs can arise outside the actual building activity that are not directly related to developing the physical structure of a project. Other costs can arise outside the actual building activity or not be directly related to the physical structure being built. These indirect building costs remain outside the actual building cost estimates and do not fall directly under the control of the building team.

- If a building activity has an uncertain building budget environment then quantifying the risks and uncertainties associated with it can be done more suitably through a qualitative risk analysis approach than by traditional methods. After risks are identified and quantified, clear responses should be developed and included in the risk management, and thereafter in the project cost plans.

- Early risk identification, quantification and treatment of risk should contribute to the selection and determination of the most significant high-impact cost variables, based on risk priority, clusters and broad entities. The professional building cost consultant should prioritise the relevant parameters and identify those which are significant to the final building estimate. As information is often inadequate at the early project development stage, the consultant should use abstracted risk indicators for risk assessment and evaluation.

- Risks are specific to a given building project and to a particular budget environment, even though some important cost entities and physical features of the future building projects might not yet be defined, specified or known.

In this chapter the essential background to building risk and risk identification in building projects has been explored and it was found that early identification would aid budget prediction through the proactive assessment of significant risks.

The significant risk profile identified in the literature includes important risk variables such as: market, political, technical, financing, environmental, cost estimate, schedule, and operating, organisational, integration and *force majeure* risks. To determine current practice in the evaluation and treatment of potential risks, certain profiles were used to explore risk management, by using risk representatives or risk indicators. These profiles were contract, client professional team, estimating, natural and external risk (Edwards, 2001).

Despite a lack of prior project information and the poor background knowledge of building risks, the identification method for risk indicators described in Chapters 2, 3 and 4 is justified, making it possible to engage in a process of collecting and analysing data for this research.

It is considered justifiable to design a research methodology – described in the next chapter – that investigates risk management in cost planning and the control of building projects in Kenya, to support the hypothesis that the risk management functions exercised by professional consultants in cost planning and control are ineffective.

CHAPTER 5

Research Methodology and Design

5.1 Introduction

Chapters 2 and 3 discussed the background to this study's research problem, and Chapter 4 followed with a description of risk issues that are likely to manifest themselves in the practice of risk management.

This chapter describes the development of a research methodology and design that is used to address the problem stated in Chapter 1:

In construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget, as determined by the professional building cost consultant.

The chapter is structured around a discussion of the research methodologies (Section 5.2), a summary of research survey issues (Section 5.3), a justification for the use of the opinion survey and case-based approaches (Section 5.4), a description of the opinion survey (Section 5.5) and the case study (Section 5.6), and ends with conclusions (Section 5.7). Outlining the method at this point in the thesis enables the reader to see the overall research concept. The data collection and processing was undertaken in four steps; research methodologies, practice issues in survey research, opinion survey questionnaire, and case study interviews.

The first section (Section 5.2) provides a basis for formulating the research methods, and the subsequent sections discuss the reasoning behind the selection of the methods, and justify the methods used in the research design.

5.2 Research methodologies

This section discusses general research theory and is followed by a methodological review of different research methods, to identify the issues of practice in current research. The use of the selected research method on practice issues is then justified. It was important to review the current research methodologies as a basis for discussing the chosen research methods. The section describes methods of inquiry (Section 5.2.1), practice issues in survey research (Section 5.2.3) and limitations of the research survey (Section 5.2.3).

5.2.1 Methods of inquiry

This section provides the basis for the research method and summarises the method adopted.

The traditional perception of scientific inquiry is based on theory, concept building, data collection and interpretation (Babbie, 1995). Based on the theoretical concepts, a researcher collects data relating to certain empirical variables. In order to understand these variables more fully, he or she then expands the theory to explain the meanings of events and outcomes. The purpose of the methodology utilised in collecting data relating to current cost practices was to provide a basis on which the research problem would be resolved by furthering understanding of relationships, identification and processes (see Fellows and Liu, 1997).

A research design should be theoretically driven (Morse, 1991, cited by Creswell, 1994), with empirical variables identified, to explain events by using existing theory. The research may be done by qualitative methods, while incorporating a complementary quantitative component that assists in building a theoretical background on which to develop new theory or build explanations based on existing theory. In a two-phase piece of research such as this, the literature and theory is used inductively in the qualitative phase of the study, and deductively in the quantitative phase (Creswell, 1994).

The adoption of a research design creates an abstract deductive theory based on existing knowledge and a variety of concepts relevant to the likely causes of the problem being researched. Concepts are established and likely variables are used to represent theoretical concepts that are precise and specific to established theory. Using a data collection method – such as a survey – that is appropriate to the research topic and situation, a researcher collects data relating to the empirical variables by means of field research techniques (Babbie, 1995).

The choice of a method depends upon the objectives of the research. If the objective is to gather opinions and future intentions, Silverman (2000) recommends field survey research, but when exploring case histories or activities and events, Creswell (1994) favours qualitative methods such as case study interviews.

In this instance the term 'survey' refers to the method of securing information concerning the risk and financial outcomes under study from all or a selected number of respondents in the 'universe' concerned (Creswell, 1994; Kothari, 1990). In the highly competitive and secretive cost environment, sample survey is an appropriate method of data collection. In this method, random samples and measurable variables are generated from the population. There are three reasons for choosing a survey-based method. Firstly, it is representative (Silverman, 2000), secondly, according to Babbie (1995), survey research is flexible since it involves collecting data from the field either asking people questions or using a self-administered questionnaire, and thirdly, surveys can elicit expert opinions and provide meaningful, current primary data through direct communication with the respondents.

5.2.2 Review of survey research

Section 5.2.1 alluded to the concepts of survey research. A chronological review is now presented of survey-based research on risk in construction and building projects, published from 1995 to 2002, with comment on the methodological strengths and weaknesses of each. The review uses authoritative journal articles and conference proceedings as a background to the issues surveyed in this study. It aims to justify the use of the research methods adopted here.

The oldest article reviewed here is that of Kometa et al. (1995), who surveyed 300 consulting firms in UK. They used a qualitative questionnaire to investigate and quantify client-generated risk by project consultants. They ran a pilot survey, where 52 consulting firms took part, in which the questions were tested for comprehensibility. In the main survey, 300 questionnaires were distributed, of which 115 were completed and returned – a response rate of 38 per cent. The clients' attributes were identified from these data, using a framework based on a detailed literature search. The main survey was followed by formal interviews of selected respondents. The questionnaire survey was then analysed, using quantitative analysis in a two-stage approach: firstly, using a 'relative importance in current practice' variable, and secondly, by ascertaining the weight constants attributable to these variables. However some of the management factors – for example financial stability, past performance and organisational quality of firms were subjective and could have been misinterpreted by respondents. This may well have affected the accuracy of the knowledge obtained and quantified.

Scott (1995) used 22 organisations in the United Kingdom in an analysis of contractors' difficulties in implementing project construction work plans. It is clear from his survey that most engineers considered that checking plans was the first priority in risk management. Work programmes on two major projects were studied and a questionnaire survey then carried out. The response rate was 45 per cent. Interviews were then conducted in the respondents' offices or site huts. A technical weakness of this research was that the researcher obtained his data from a single group and did not utilise a second method, so a rigorous gathering of information possibly did not occur. The value of this research lies in its confirmation of existing knowledge.

In a questionnaire survey sent to 284 CEOs from oil companies, Pablo (1997) received a 21 per cent response. He found that, in reconciling predictions under risk, risk managers need to focus more on project risk profiles and training. Respondents were presented with a framed open-ended questionnaire, and regression was used to analyse the data in an attempt to address the non-technical quantification of risk situations. The questionnaire was open-ended because he believed that cost managers hold widely divergent views on the handling of risk in buildings, some taking a more analytical approach while others appear to operate on a more intuitive basis. The respondents did indeed hold widely divergent views, making the data collection difficult with the standardised questionnaire instrument. The findings supported the acknowledged fact that a firm's experience is likely to influence cost prediction.

The views of experts in the construction industry – architects, engineers, quantity surveyors and construction owners' (clients) representatives – were surveyed by Adams (1997) in Nigeria. A total of 400 questionnaires were sent to indigenous contractors and construction professionals in the building industry, and 140 of these were returned (35 percent). Respondents were selected using a variety of sampling techniques. The questionnaires consisted of open-ended and closed questions. The respondents rated problems of uncertainty in obtaining interim payments, access to finance and capital as significant risks in budget prediction, but none of them reported having used statistical techniques to analyse financial risks. There was consensus that delays in payment (such as delayed cost reports, non-completion of final accounts and inaccurate progress valuations) are major constraints and are detrimental to financial planning. A weakness of this research lies in the non-random sampling techniques used.

Tam and Fung (1998) used the interview survey technique to explore the safety attitudes, practices and characteristics of construction firms in Hong Kong. The 45 companies reviewed comprised 11 small-scale, 25 medium-scale and 9 large-scale construction firms. The researchers investigated the relationship between set safety measures and safety performance. Multiple regression analysis was used to study the combined effect of the contractors' performance and the degree of significance allocated by the respondents to each safety management strategy. In an interview survey, respondents do not have time to consider replies or look up information, so that there may be some doubt regarding the accuracy of the data collected. The strength of the approach is that first-hand experience and applicable information are imparted, although the time, skill and effort required in collecting that information inflated the research costs. The sample size was too small to generalise amid a large population, but the strength of this research design lies in the spontaneous answers obtained more than the absolute accuracy thereof.

Dey et al. (1998) used a risk analysis model with 30 Indian pipeline operators to investigate pipeline management failures. Respondents were given a form to complete involving various aspects of pipeline construction and maintenance. Their preferences, and therefore their judgements, were translated into numerical values on an 'intuition/judgement/experience' basis, on a scale of 1 to 9. Matrices of judgement were then used to compare risk factors – since the selection of a particular inspection technique depended on the operator's experience. Quantitative techniques of risk analysis were used, in a Monte Carlo simulation, based on PC-software Micro-Manager. The data obtained from the respondents might however have been inaccurate because of a significant delay between the questioning and the actual entering of the data. In addition, the answers obtained from that one group of managers may not be sufficiently representative. The evidence presented indicates a research tool that was not adequately rigorous. In view of such an unnatural setting (a conference room) and the tool used to collect data (a form containing pipeline problems) it is not certain whether the precision required in data collection was attained. Moreover, the respondents knew they were being investigated and the information provided might therefore be limited.

In another survey, Wang et al. (1998) used a postal questionnaire to study the effectiveness of construction automation in Taiwan, mailing 400 copies to construction firms, architects, government agencies and consultants. Ninety-three questionnaires were completed and returned but only 60 were usable in the survey. This was only a 15 per cent response, and the researcher explained that the low return was due partly to incomplete information provided in the questionnaire. The study consisted of eight survey items on commitment (cost impact) and seven more on benefit opportunities. The respondents' preferences were translated into indices and prioritised according to their weight index. The weakness of this approach lies in the researchers' assumption of the validity of the rating scale, as similar scoring was applied consistently across all categories. The risk of collecting incomplete and wrong information is increased in this research because of the misunderstanding that might have arisen from the incomplete information provided in the questionnaire. Therefore the data collected were probably inadequate, resulting in only limited conclusions.

A stratified random sample of 617 out of 2450 registered members was used by Nkado (2000) to collect data from the field to investigate the competency of professional quantity surveyors in a developing economy (South Africa). He used a structured questionnaire administered nationally. Of the 617 targeted, 150 practitioners completed the questionnaire – a 24 per cent response rate. Factor analysis and rankings were applied to interpret the data. Respondents ranked marketing and financial management as the most important competencies. The survey makes no mention of the fact that allocation of financial and market competencies might be influenced by variable relationships. The structured questionnaire proved to be a suitable means of gathering information from the field, but the precision achieved from the data may not have been satisfactory because all respondents might not have been exposed to the same level of quantity surveyor competencies. In addition the data collection tools lacked a vigorous exchange of information, while the structured questions were directional, thus being even more inflexible.

Love and Li (2000) used case-study project data collected on site during building development to investigate the absence or presence of the quantification of reworks in Australian firms. Their findings demonstrate that cost impact problems usually arise out of incomplete or erroneous information. They found that contractors were mainly concerned with the difficulties of accurate cost planning (including quantity surveyor's appointment, estimating final building cost, evaluating the estimating method chosen, price rates used, budget planning, cost plans, checking the estimate, and accuracy level expected). The value of this research lies in its prediction of potential quality failures in building projects rather than in finding solutions for uncertainty in buildings. It permits the exploration of inter-relationships of causal factors, enhancing the knowledge of the researcher and thus increasing its analysing ability. Data gathered using a case study approach takes relatively long to complete, compared with the interview method.

Akintoye (2000) used 24 factors in a questionnaire survey which examined those estimating practices of UK contractors which were relevant to risk in cost estimating practice. The questionnaires were mailed to 200 firms, selected randomly from available lists of contractors. Eighty-four firms returned completed questionnaires, representing a response rate of 42 per cent. Respondents rated complexity, technical requirements, project information, team requirements, contract requirements, project duration and the market requirement as significant risks. An advantage of the postal questionnaire method is that the survey can be distributed widely to known firms and organisations and to many people at low cost, even when the target population is large and widespread. However, the weakness of the research method lies in the fact that the answers may not be entirely the respondent's own, so the responses may not be truly representative.

An empirical survey carried out in Hong Kong by Cheung et al. (2001) used 100 questionnaires aimed at measuring leadership behaviour and the satisfaction of the respondents regarding their project design team. The study used structured questions on leadership and satisfaction in building projects. A total of 67 responses were obtained, of which 10 were incomplete. The results, developed by multiple regression analysis, indicate that participant leadership is the dominant preference, but it also showed that the respondents were not offered a chance to evaluate risk prevention and communication variables in project leadership. The advantage of this type of research is that subjective bias is eliminated if the observation is done accurately. Moreover, the information obtained is current, demanding active cooperation on the part of the respondent.

Elkington and Smallman (2002) used a technical risk profile from the utilities sector in a British case study. A questionnaire survey was sent to each of the 20 project managers in a utility company. Twelve questionnaires were completed, only ten of which were analysed, as the remaining two were incomplete and therefore discarded. They found that many potential risks in planning are not even noticed. However, the respondents were not given a chance to confirm the findings in face-to-face interviews so that the researcher was not able to rate the knowledge and success scores of the project managers. The weakness of the research lies in the assumption that knowledge and experience was the main variable in the success score, thus weakening the study and thus the results obtained. However, although case studies are seldom comparable, the strength of their research design lies in the data richness obtained from each respondent who describes or narrates the experiences of the unit under consideration. Nevertheless, as already pointed out, the expense related to the timing and duration of a case study remains a major constraint.

Three merits of survey research are evident (Nkado, 2000; Elkington and Smallman, 2002). First of all, as a primary data collection method, a survey allows data to be collected from the field. Secondly, it is useful in describing the characteristics of a large population (see e.g. Akintoye, 2000; Nkado, 2000, Wang et al., 1998; Kometa et al., 1995). Lastly, using a standardised questionnaire enables current data to be collected with the required precision (Akintoye and Fitzgerald, 2000).

Advantages of the questionnaire method are that cost is low and a considerable amount of current information can be collected in this way. A standardised questionnaire is particularly effective when the measurements made are amenable to statistical data analysis. Evidence in an opinion survey from the reviewed literature indicates researchers' preference for questionnaires (Akintoye, 2000; Cheung et al., 2001). Another advantage of a questionnaire is that opinions could be obtained on current practices.

A questionnaire supplemented by a selected case study is a method that provides rich comprehensive data (Edwards, 2001; Love and Li, 2000) since the gaining of information in the case study can usually be controlled effectively in an interview.

The different survey instruments used by researchers – such as questionnaire, case study and interview surveys – meet their objectives with varying degrees of success. Cheung et al. (2001) and Wang et al. (1998) favoured the postal questionnaire survey, whereas Elkington and Smallman (2002) and Love and Li (2000) used case studies. Tam and Fung (1998) used the interview survey on its own.

Evidence emanating from the research literature (e.g. Edwards, 2001; Scott, 1995; Kometa et al. 1995) indicates that the best results are produced by combining research methods. Among the reasons for this is firstly that, in a questionnaire, the researcher plays a passive role but covers a large population that can bring in diverse opinions. Secondly, based on construction practices, costs are confidential and difficult to obtain from competing firms.

Confidential practices in cost application imply that survey-based non-participation research, such as questionnaire opinion surveys and case-based approaches, are appropriate research methods to meet the aims of this study. It was believed by the researcher that supplementing the findings by a case study interview would confirm the results, thus increasing reliability of the findings and the research conclusion.

5.2.3 Limitations of the survey research

Several issues arose from the above-mentioned literature, including some flaws in the research surveyed. The researcher's methodology review is thus limited by the validity and reliability of the data gathered by the authors reviewed and the applicability of the statistical tools they used in analysing their data (see Cheung et al., 2001; Wang et al., 1998). The following errors were found:

- Some of the researchers (e.g. Tam and Fung, 1998; Adams, 1997) applied basic social science survey techniques ineffectively.

- Some researchers did not maintain strict scientific social research standards (Pablo, 1997; Wang et al. 1998), for example in some cases the random sampling requirements were not fulfilled (Kometa et al., 1995; Scott, 1995; Adams, 1997).

- In the published research, not only were the opinions subjective, but also the data and conclusions could apply to only a few risk events and outcomes (Scott, 1995; Akintoye, 2000; Elkington and Smallman, 2002).

- The surveys were not rigorous enough to be generalised (Dey et al., 1998).

- Findings and conclusions could not be sustained due to the size of the sample (Pablo, 1997; Wang et al. 1998; Nkado, 2000).

- The data collected were inappropriate for the analysis, such as multiple regression analysis, weighted scoring, and matrices of judgement (Dey et al. 1998; Tam and Fung, 1998; Nkado, 2000).

- Pilot testing to gauge the appropriateness of the questions and the calibration of rating scales was seldom or never carried out (Scott, 1995; Dey et al.,1998).

- Questionable data transformation and data analysis might have resulted in inaccurate recommendations based on biased results (Nkado, 2000; Akintoye, 2000).

- Finally, some researchers used a single source of data, which does not provide an objective judgement of performance nor give a balance in the information collected (Scott, 1995; Dey et al., 1998).

An opinion survey is used to obtain knowledge from individual persons or groups or units (Babbie, 1995). Survey research can be effective only when respondents cooperate and when they definitely have basic information on the matter under investigation (Kothari, 1990). However this rarely happens simultaneously in construction projects. Inter-group cooperation is very difficult to attain in building work because professions have diverse training and obligations and hold varying perspectives on costs (Edwards, 2001; Pablo, 1997). Groups giving information in an uncooperative, biased manner create information barriers thus illustrating a general problem with the postal, anonymous questionnaire opinion survey (Atkinson, 1998; Loosemore, 1995).

It is unreasonable to expect all researchers to use similar terminology and risk profiles, and indeed the researchers have used different terminology and categorisation of construction problems (Akintoye, 2000; Akintoye and Fitzgerald, 2000; Nkado, 2000). The likelihood of a wrong conclusion lies in the interpretation of the adopted terminology and the generalisation of specific data, or of data being based on non-comparable terminology or on a non-identical project profile (Elkington and Smallman, 2002; Scott, 1995;). Despite efforts made towards improving opinion survey research, the opportunities for generalising findings still cannot support the formulation of theories if terminology and standardisation of recording of information is inconsistent (Cheung et al. 2001; Nkado, 2000; Adams, 1997).

The work under review did not refer to specific building project, rather it took the form of general opinions (see especially Nkado, 2000 and Kometa et al., 1995). Although attempts have been made to explore construction theories from abstract knowledge, recommendations to create changes in practice have not evolved out of that knowledge without reference to specific projects or building events (Akintoye, 2000; Nkado, 2000). Furthermore, precision in data collection is unlikely to develop in the immediate future, hence specific case knowledge and observations are vital to accurate recommendations (Love and Li, 2000; Wang et al., 1998; Pablo, 1997).

Limitations have been observed in the three methods of data collection, namely questionnaire opinion survey, case study and interview methods. The questionnaire has been the most commonly used instrument for collecting field data. The methodological review shows that opinion survey research arguably lacks the ability to generate data richness from the general information provided by questionnaires alone (Edwards, 2001; Akintoye and Fitzgerald, 2000) but has advantages over other methodologies when gathering information in an opinion survey and because of lack of data richness the questionnaire was supplemented with case study interviews. The opinion survey researcher can seldom develop accurate recommendations without specific information from live projects, making this a limited method, whereas case studies enable patterns and interrelationships to be understood.

One limitation of the case study method is the assumption that knowledge and experience are repeated in all projects. It is a fallacy, however, to assume that a pattern observed in one project will occur in other projects. An alternative to the direct use of project information would be project stories and narratives. Story-telling may be based on hindsight, but socio-economic changes can affect an existing pattern thus weakening the comparative results obtained in a case study survey (Elkington and Smallman, 2002; Love and Li, 2000).

Among the limitations of the interview survey method are that respondents do not have time to consider replies or to look up information, so that the accuracy of the data collected is doubtful (Tam and Fung, 1998). This method is expensive because good interview skills are often required, so interviewers often have to be trained – at an extra cost. In addition, the time they take limits the number of cases possible in an interview survey.

Notwithstanding these problems, a case study interview researcher can observe a real and enlightened record of personal experiences and project history. A case study executed using different methods, such as a pre-interview questionnaire could successfully investigate the way in which respondents think and act (Cheng et al. 2001; Love and Li, 2000).

5.3 Summary of research survey issues

The research survey has contributed to knowledge but often lacks a vigorous application of scientific research procedures – for example for dealing with inconsistencies in data collection. Survey techniques affect research conclusions and can therefore potentially undermine the value of research findings. The opinion survey technique is affected by the low rate of returns and questionnaire inflexibility and in many cases a better approach would be studies to satisfy research objectives rather than a complicated opinion-based survey. Implicitly, there is a need to combine the opinion survey with other research methods in order to exploit the advantages of each method. Explicitly, the reviewed methodologies have shortcomings in terms of controversies and arguments for and against selected methodologies.

Flaws in methodological surveys, many of which have been indicated in the foregoing examples, could be summarised as follows:

- There was a failure to apply strict research standards with a single-source data.
- All respondents were treated in the same way although some needed more time to consider opinions and consult records.
- Data-capture techniques and research administration were sometimes poorly applied.

- Choices of data-processing techniques were sometimes inappropriate.
- There was a failure to explain terms and concepts clearly.
- There was a lack of specific field information.
- There was frequent inaccurate generalisation of information.
- Unjustified assumptions were made that a pattern developed in the past would continue in the future.
- There was over-reliance on incomplete and inadequate information from poorly-worded questions, leading to poor or even invalid conclusions.
- There was a lack of participation from the researcher.

Other shortcomings of the questionnaire research survey method are that it lacks precision of data, and the information gathered could be out of date by the time it is collected. This particularly affects the questionnaire opinion survey. However, in spite of its shortcomings as a principal research instrument, it is an appropriate census survey technique – although opinion research survey should, if at all possible, not stand alone.

Some of the merits of the opinion survey technique were revealed in the literature: firstly, an opinion survey is an appropriate method of data collection on an infinite 'secretive' population, i.e. one where cost data are considered confidential; secondly, the information obtained relates to what is currently happening and, thirdly, it provides the evidence required for justifying more detailed investigation of case studies to supplement the information gathered.

5.4 Justification of opinion survey and case-based approaches

In research on opinion surveys it is difficult to know whether the willing respondents are truly representative. The sample size is often restricted by the high cost of obtaining data and thus it is never certain that what is observed is normally representative of the population. A large population of respondents can be reached conveniently through a mail questionnaire but the major constraint in survey research is that respondents do not have time to check the meaning of terms or concepts.

In summary, the flaws observed from/in the methodological review (as mentioned in Section 5.3) need to be resolved, justifying the use of an opinion survey in the current research. The flaws and their impacts on this research have been minimised wherever possible in order to increase the validity of the collected data. For example:

- All the industry experts surveyed – the construction professionals (architects, engineers and quantity surveyors) – had the opportunity to participate in the research. They were surveyed together with construction owners, to provide an objective idea of the cost consultants' opinions. This resulted in balanced findings.

- All respondents were given adequate time to consider their opinions – since self-administered questionnaires allow for that – resulting in respondents giving well reasoned answers.

- Data coding and processing shared a common base, for example Likert scales were used to communicate ordinal properties to the respondents as cost data are treated as ordinal scales in building tendering.

- The research survey was designed with daily-encountered terms used in professional practice training. To eliminate misinterpretation, respondents were provided with communication channels where they could ask for explanations, interpretations and guidance when necessary, but the research remained anonymous.

- The respondents were asked to choose from provided answers, in order to reduce misinterpretation, and were advised to use their current project(s) as a basis of their choice.

- Case histories, which generally produce a fairly exhaustive study over a long period of time, were used to ascertain the history of events or impacts.

- The researcher built in a number of checks – such as enquiring on similar areas in different sections – to ensure that errors or deliberate malpractice did not go undetected.

- The researcher was able to check and supplement the information from the questionnaire through first-hand information gathered in the face-to-face interviews. Face-to-face interviews are acceptably accurate and are interactive, being conducted specifically to observe selected cases (Edwards, 2001; Fellows and Liu, 1997; Babbie, 1995).

After considering the flaws observed in the methodological review, the researcher chose a combination of an opinion survey using a questionnaire instrument, and case study interviews. This would be supported with a supplementary data-collection tool of interview surveys on selected case studies.

The opinion survey was designed to allow for the variables described in Chapters 2, 3 and 4. The theories were amplified and tested against a wide Kenyan building fraternity and later confined to five case studies. The responses received from the opinion survey provided guidance for the selection of five case study respondents, and for the formulation of the structured question format adopted for their interviews. In addition to being a source of rich data, it focused direct attention on the research problem stated in Chapter 1.

5.5 Primary data capture instrument - Opinion survey

Linked to the matter of the opinion survey were the participants and the principal instrument, design and administration that were essential to information flow. This section discusses research subjects (Section 5.5.1), use of the questionnaire (Section 5.5.2), questionnaire design (Section 5.5.3), questionnaire administration (Section 5.5.4), questionnaire response (Section 5.5.5) and data processing (Section 5.5.6) in order to establish the basis of the principal data capture. The section concludes with a summary (Section 5.5.7).

5.5.1 Research subjects

In this study respondents were drawn from a wide spectrum of the Kenyan building sector, covering the whole country. They had adequate time to fill the questionnaire and return it within the time stipulated in the covering letter.

The research subjects chosen for the opinion survey were four groups of cost-related consultants in the Kenyan building sector. They comprised professional building cost consultants drawn from the engineering, architectural and quantity surveying firms or from organisations registered as consultants with the Ministry of Roads, Public Works and Housing. The Institute of Quantity Surveyors of Kenya and the Kenya Institute of Architects provided addresses and names of respondents' firms. The Construction Group Members' list of February 2000 and the East African Building and Construction Directory, 1999–2000 provided an additional list of registered firms working within Kenya, and the list of clients was derived from the Nairobi City Council Approved Building Plans 1999–2000 and from other approved building plans from the other major towns of Kenya. Addresses of owners and agents were used to source the research subjects from within Nairobi and other regions of Kenya. This was all done in an attempt to increase coverage to as many clients and consultants as possible. A wide sampling of knowledge and opinions on cost assessment was important to ensure data validity and the reliability of the survey results.

Opinions were also sought from client representatives in government and local government departments, quasi-government building departments, local authorities and other public organisations throughout Kenya. In this way a fourth group, the public client organisations, were incorporated into the research to provide an objective opinion of consultants' performance.

Notwithstanding the problem of finding readily available census survey data of respondents, all registered building consulting firms and organisations, as well as other firms supporting building development in Kenya, were incorporated into the research group. Altogether there were 77 quantity surveying, 102 civil, structural and service engineering, and 131 architectural firms and organisations surveyed. In addition, surveys were sent to 199 building client organisations, developers, government, and quasi-government building departments, local authority and utility company building sections.

5.5.2 Use of the questionnaire

The use of a questionnaire as the main source for the opinion survey was decided on for a number of reasons. Its structured, predetermined questions and standardised techniques of recording responses provided a major advantage over other instruments. Firstly, data collected in this way are more amenable to statistical analysis, making feasible large samplings with self-administered questionnaires. More importantly it allows coverage of a wide geographical area, producing a wide spectrum of opinions from the industry.

As a research tool, a questionnaire is subject to various limitations, such as maintenance of anonymity, social-economic differentials, inflexibility and uncontrolled replies (Fellows and Liu, 1997). The tool used in this study was designed to reflect non-confidential details of project experiences so that controversial questions and business details were avoided. Secondly, respondents remained anonymous and were assured that the data would be used without making known its source.

A primary concern in questionnaire design is the degree of structure to impose on the respondent. In this case participants were offered the questionnaire as a closed instrument with a choice of pre-determined answers, to ease data processing (see Atkinson, 1998). The multiple choice answers provided an opportunity to choose an answer without respondents having to check their records, thus aiding spontaneous responses. The options provided in the multiple choices were established from theories explored in the literature survey, so the questions and listed answers were expected to reduce researcher bias and thus provide accurate and current data.

An expected feature of the mailed questionnaire instrument is a low return rate. More important than mere lack of numbers, however, is the probable resulting bias due to non-response (Babbie, 1995). Loss of control once the questionnaire has been distributed leaves the researcher at the mercy of the respondents, so it was deemed necessary to supplement the principal instrument with a secondary information-gathering tool. This will be discussed in Section 5.6

5.5.3 Questionnaire design

Four questionnaires were prepared. Three of these were intended for professional building cost consultants: engineering, architectural and quantity surveying practices, and the fourth was directed, under the general heading of 'Client', at client organisations, government, and quasi-government building departments, local authorities and the building sections of utility companies.

The questionnaires differed in emphasis, ranging from a cost consultant's point of view to a project manager's perspective. Each questionnaire comprised 28 questions, divided into four sections, namely: demographics, cost planning and control, risk management, and treatment of potential risk. In addition, the questions were adapted so that terms appropriate to the intended group were used, and, further, some questions specific to a particular respondent group were added. Summaries of the survey responses are given in Table 5.1.

In Questions 1.1 to 1.8, respondents were asked questions relating to demographic information regarding themselves and their firm. These included physical location, staff establishment size, respondent's position in the organisation, years of experience in construction, gross project turnover, workload, and types of procurement systems and documentation used in project costing.

Questions 2.1 to 2.13 endeavoured to establish the respondents' knowledge and experience in the current practice of cost planning and control in Kenya. They aimed at exploring familiarity with, and the application of, cost planning skills. Items included were length of time working with the project team, method(s) used to provide an estimate, rates used to compile an estimate, current practices of cost planning, stage of establishment of the first budget, checking of cost plans and expected accuracy level of estimates.

Questions 3.1 to 3.3 concerned 69 risk factors and sources that explored the respondents' risk management approaches, their familiarity with risk management theory, and their experience of risk management practice. Respondents were asked to base their rating on one specific project that they were currently or had recently been involved in, preferably at a pre-construction stage. They were requested to focus on specific risk-generating issues that were fresh in their minds, to elicit proactive information rather than retroactive risk management applications. Ratings were asked for on frequency of risk occurrence, cost impact of risk, and risk response to the given risk profile. The risk source or factor profile was based on contract, professional/client team, and on estimating, project and external risks.

The questionnaire profiled 23 factors or sources used to rate risk management, knowledge and experience. Contract risk factors and sources were the size, location and complexity of the project, conditions of contract and type of procurement system. Client/professional team risk sources consisted of quality of design information, design completeness, type of client, design variations and project brief uncertainty. Estimating risk sources included estimator's experience, quality of the estimating data, payment valuations, and timeous completion of final accounts. Project risk sources were made up of natural events and contract period overruns. External factors or sources were inflation, political uncertainty and interest rate changes.

Questions 4.1 to 4.6 asked for respondents' opinions regarding the type of information they considered important in the treatment of potential risks. Creativity and imagination are essential tools in the treatment of potential risks, thus it was seen as important to establish the nature and extent of the treatment of potential risk applied by respondents during budget planning as well as during the control of building projects. Proactive thinking and planning of cost impacts are crucial for testing the available treatment of risk. Respondents were thus asked about their risk management approaches, as well as their familiarity with and experience of the treatment of potential risks. The questions dealt with familiarity with risk management theory and practice, the efficacy of traditional methods in incorporating risk in budget, the use of risk analysis techniques, the application stages of risk analysis techniques, and budget communication with respect to risk. Copies of the questionnaire are given in Appendix 2 (see Sections in the questionnaire in Appendix 1).

5.5.4 Questionnaire administration

The appropriateness of the research questions was pilot-tested on 20 respondents, to ascertain the validity of the survey instrument. The test groups were made up of five firms from each study group – engineering, architectural, quantity surveying, as well as client firms and organisations. Changes to the questions were then made, based on the pilot survey comments and results.

The pilot questionnaire was administered by mail, and respondents were asked to complete and return it by post, using the enclosed stamped self-addressed reply envelopes. From the twenty questionnaires sent to the four survey groups mentioned above, the numbers of returns were three, two, four and five, respectively. Six firms or organisations failed to respond, in spite of several reminders.

After appropriate changes had been made, improved questionnaires were posted to 489 firms in the building profession and client organisations throughout Kenya. This was done during May 2000, with a suggested date for their return. The forms were completed and returned over the next four months. Subsequent research was administered from Nairobi

Details of follow-up procedures were as follows: two weeks after the initial mailing, a telephone call was made to confirm receipt of the mail and to remind participants that the completed questionnaire was due at the end of 30 days. After another four weeks a complete replacement instrument was sent to respondents who had requested another copy, and as well as a reminder to those who had not yet returned the initial questionnaire. A week later (seven weeks after the initial mailing) a telephonic reminder was made and replacement questionnaires were sent out to respondents who had not returned the earlier one. In the tenth week, the questionnaire was hand-delivered, mainly to those who still wished to participate in the survey and had requested a replacement. It can thus safely be said that every effort was made to achieve as high a response rate as possible.

5.5.5 Questionnaire response

The completed returned questionnaires totalled 42, 36, 47 and 67 for quantity surveying, engineering, architectural and client firms and organisations, respectively, with individual group response rates as shown in Table 5.2 below. There was an overall response rate of just under 40 percent. The 39 per cent return rate of opinion survey in the construction industry was good considering that according to Akintoye (2000) the norm of 20 to 30 percent for most questionnaire surveys in the construction industry.

Table 5.2 shows the questionnaire response rates, giving group responses from the survey and the number of incomplete questionnaires that were returned to the researcher. This was due to wrong addressing or because the people to whom the survey had been addressed were no longer in practice, or were from firms which did not wish to participate in the survey.

Table 5.1 A summary of responses to the questionnaire survey

	Administered	Received	Response rate (%)
Engineers	97	36	37
Architects	126	47	37
Quantity surveyors	72	42	58
Clients	194	67	35
Main survey total [9]	489	192	39
Pilot test	20	14	70
Total including pilot	509	206	41

5.5.6 Data processing and analysis

The purpose of this section is to describe the coding of qualitative measurements for subsequent data processing.

For certain questions (see Appendix 2), a measure of 0 to 3 points on the Likert scale was used to represent bad/poor to good/excellent practice. The decision to do this was made on the basis that these scales communicate ordinal properties of the cost judgement of respondents and therefore produce data that can be used in a statistical analysis.

[9] Not including incomplete responses.

A different approach was adopted for questions 3.1 to 3.3, which search for a ranking of experience and knowledge in risk management for each of the profiled factors and sources of risk. For example, for each factor or source, respondents were asked to rank on a scale of 0 to 5 the outcomes they considered as representing bad to good practice. These involved risk frequencies, cost impacts and response actions at specific stages of project development. Six development stages were listed, from project inception to construction, and respondents were free to rank each factor at any point of the project development, in accordance with the instructions provided.

The statistical analysis software used in this investigation was STASTICA 6. STASTICAL 6 was the tool of choice for the analysis using the data collected for this research. The statistical tests would have shown the level of confidence expected from cost planning procedures but due to the small number of respondents the tests would not be reliable. The frequency of distribution was selected because of its suitability to ordinal scales. The subsequent analysis provided a basis for data interpretation by means of statistical methods. This was to satisfy Objective 1 of this study, namely "to identify the current practice of cost planning and control of building projects employed by professional building cost consultant firms in Kenya".

The frequency distribution of responses (expressed as percentages) helped to identify the characteristics of practice in construction projects and those risk management techniques most frequently employed by professional building cost consultants in current practice. Since there was not enough time to consider all probable risks in any given building project, this approach aimed to use the risk ranking to identify which sources of risk which would be likely to receive the most attention from risk managers (see Ward, 1999).

In summary, therefore: data interpretation was approached through frequency distribution analysis, to establish and compare current practices in cost planning and control, by identifying current risk management practices, and the treatment of potential risks.

5.5.7 Summary of opinion survey from the questionnaire

This section has discussed the opinion survey using a questionnaire instrument and has provided a brief account of the reasoning behind the selection of the opinion survey, the design of the questionnaire instrument, and the subsequent data processing.

The wide geographical area covered by the questionnaire, involving a large population in the building sector, increased the questionnaire validity.

5.6 Supplementary instrument - Case study interview

There was evidence from the methodologies explored in the literature review that case studies are needed to enhance and supplement the findings in a questionnaire study (Edwards, 2001). The first set of findings was therefore enhanced by investigating a number of events and narratives of case histories (see Love and Li, 2000; Elkington and Smallman, 2002).

Story telling is a technique for retrieving historical facts (Edwards, 2001) as it has the advantage of recalling experiences. This technique offers the researcher an opportunity to gather information from the field by means of selected and considered sample unit surveys, as opposed to the questionnaire instrument where the researcher has no control of the answers given.

Nevertheless, story telling is intimately bound up with case study – in this case as a direct opportunity to narrate and explore the risk experiences of participants (see Edwards, 2001). Ultimately, story telling becomes case stories, preferably told as freshly as possible, on real projects, providing more meaningful information than that obtained from a opinion survey alone (Edwards, 2001). Unfortunately stories narrated vary in depth and content, but the rich data available in case studies enhances knowledge, and patterns of details describing the subject matter can be used to judge, check, supplement, confirm or reject information collected through the opinion survey (Yin, 1994).

5.6.1 Use of the case study interview

Justification of the choice of case study interview-instrument and of its design is given in Chapter 7. The aim of this section is to highlight the need for a case study to supplement the findings from the literature survey, with specific and detailed information focusing on live projects.

Gathering information through case studies is a suitable method of confirming opinions expressed and exposed in a literature survey. The willing respondent is approached and asked to provide information that could not be revealed through the anonymous questionnaire survey. Certain types of information can be gathered only by participation and observation (Babbie, 1995). In a case study, the respondent is given an opportunity to expand on his or her experience and knowledge on a specific project. The interview format was selected in order to observe the cases in detail and in their natural environment (Babbie, 1995).

In addition to the time factor, the case study approach has major disadvantages in its inability to observe general trends in awareness, beliefs and preferences. The experiences and patterns described by respondents are likely to be only those which are of short duration, or which occur frequently or are reasonably predictable – so that they might be recalled. These disadvantages were disregarded by the researcher because the method was being used to supplement the questionnaire instrument as a data collection technique.

Effective participation presupposes a proper rapport of the investigator with the respondents, thus giving the study a personal touch, and case studies provide such an opportunity (Kothari, 1990). Specific incidents and project problems happen in specific cases and can be narrated, observed and recorded only through reference to a specific project (Fellows and Liu, 1997). At the same time the researcher must find patterns amidst the story telling and case history, through observation carried out in a structural interview format (Tam and Fung, 1998).

5.6.2 Case study selection process

The empirical work documented in Section 5.5 involved the use of an opinion survey conducted by means of a questionnaire. The literature had underscored the need for further investigation in response to issues raised from established practice, and enabled the researcher to select specific issues to facilitate the understanding of current practices. In addition, a close study of specific cases would enable the researcher to probe more deeply into projects, as well as into the ideas and opinions of project participants.

While the questionnaire research instrument provided adequate representative opinions of the diverse building industry, it lacked a deep specific exploration of project costs and that prompted a case-based research design.

There was, however, a problem in that an interview setting would be impractical when information was sought from respondents spread out over a wide geographical area. This meant that the case study interviewees would mainly have to be selected from an area in and around Nairobi.

Data collected from the case study interview was expected to support observations from the questionnaire opinion survey. It provided a means for establishing internal validity and drawing conclusions from the literature (knowledge) and the questionnaire opinion survey.

5.6.4 Summary of case study justification

This section aimed to address the research problem in greater depth by supplementing the questionnaire survey with a case study. It covered the development of case-based design to capture contemporary issues focusing on real life contexts.

The strategy of the case-study protocol comprising case-study interviews is discussed in Chapter 7. A case-based analysis of the data with explanations, building from comparisons of reports from the various case studies is presented in Chapter 8.

5.7 Conclusions

This chapter has examined survey-based approaches and the selected survey methods of an opinion survey and case studies. The research instruments of questionnaire survey-based research followed up by case studies were proposed and justified.

In a questionnaire survey the researcher has no control over the answers given but receives information as a passive participant. However, the case study technique offers an opportunity for the researcher to gather information from the field through selected and considered cases from active building projects.

The next chapter (Chapter 6) examines the analysis and interpretation of the mail questionnaire survey data.

CHAPTER 6

Data Analysis and Interpretation

The Questionnaire Survey

6.1 Introduction

Chapters 2, 3 and 4 provided a theoretical basis for the identification of variables that affect risk management in cost planning and control. Chapter 5 explained the chosen research methodology and the data collection procedures. This chapter documents the collected data, together with its interpretation and implications for current practices.

The analysis of the data is reported in four main sections:

- demographics and data of the respondents
- the practice of cost planning and control in Kenya
- the nature and extent of risk management performed by quantity surveyors in Kenya
- the treatment of potential risk in cost planning and control.

The examination of the data is given in four sections because the data analysis and interpretation of the questionnaire opinion survey was extensive and has been summarised to make it readily understandable. The analysis does not strictly follow the questionnaire layout (see Appendices 2) but is presented in 'risk themes', for the purpose of identifying significant risk indictors and the appropriate method of risk management in cost planning and control of building projects. Statistics given refer to responses to individual questions and are used to indicate trends rather than absolute precision

The service of cost planning offered by the quantity surveyor is based on the information received from the building team of client, architect, quantity surveyor and engineer, and on the anticipated future building market. In this service it is crucial that the nature of the respondents and their project be established through the type and nature of the building teams involved in the project, in order to satisfy recommended practice and procedures.

Six themes were considered by the researcher to be essential components of cost planning and to identify factors that affect risk management in cost planning and control, as well as satisfying recommended practices. These were therefore chosen for examination of the study data. The themes chosen were:

- nature of the respondent's risk
- information and data risk
- quantifying, accuracy, cost impact risk
- frequency of event occurrence risk
- response risk
- assessment and communication risk.

The rationale for selecting the first of these themes was that the nature of the respondents was important in the study, particularly in establishing the type of client, architectural, quantity surveying and engineering firms operating in the Kenya building sector.

The information and data risk theme was chosen since it is an essential basis on which estimate detailing is dependent. Without information and project data, estimates would be building forecasts rather than estimates (Drury, 1992). Estimate prediction relies on the breakdown of the physical structure plan to arrive at an estimated cost plan.

The quantifying of information, its accuracy and cost impact was selected for its influence in arriving at the cost plan. These three sub-themes influence the nature and extent of cost planning offered by the quantity surveyor.

Themes covering frequency of event occurrence and response risks were selected due to the manner in which risk is incorporated into cost plans. Cost estimating is conducted using historical records and experience from past projects. The incorporation of risk into the cost plan depends on the frequency of risk occurrence and its potential consequence. Lastly, the assessment and communication risk themes was selected because in the literature (e.g. Akintoye and Fitzgerald, 2000) estimates are shown to be greatly affected by inaccurate assessment processes used in estimating and by poor communication between the estimating team and the building team responsible for the construction (i.e. the client, the architectural firm and the engineering firm). The quantity surveyor assesses risk by using judgement, relevant knowledge and experience regarding risk events identified in the project (Ock, 1996) and therefore it is necessary to establish the nature of the judgement, knowledge and experience used in cost planning and the extent to which they are used. The hierarchical map (Figure 6.1) of Chapter 6 is presented with an aim of guiding the reader through the three stages of the chapter representing the four sections of the questionnaire and the six themes of the data analyses.

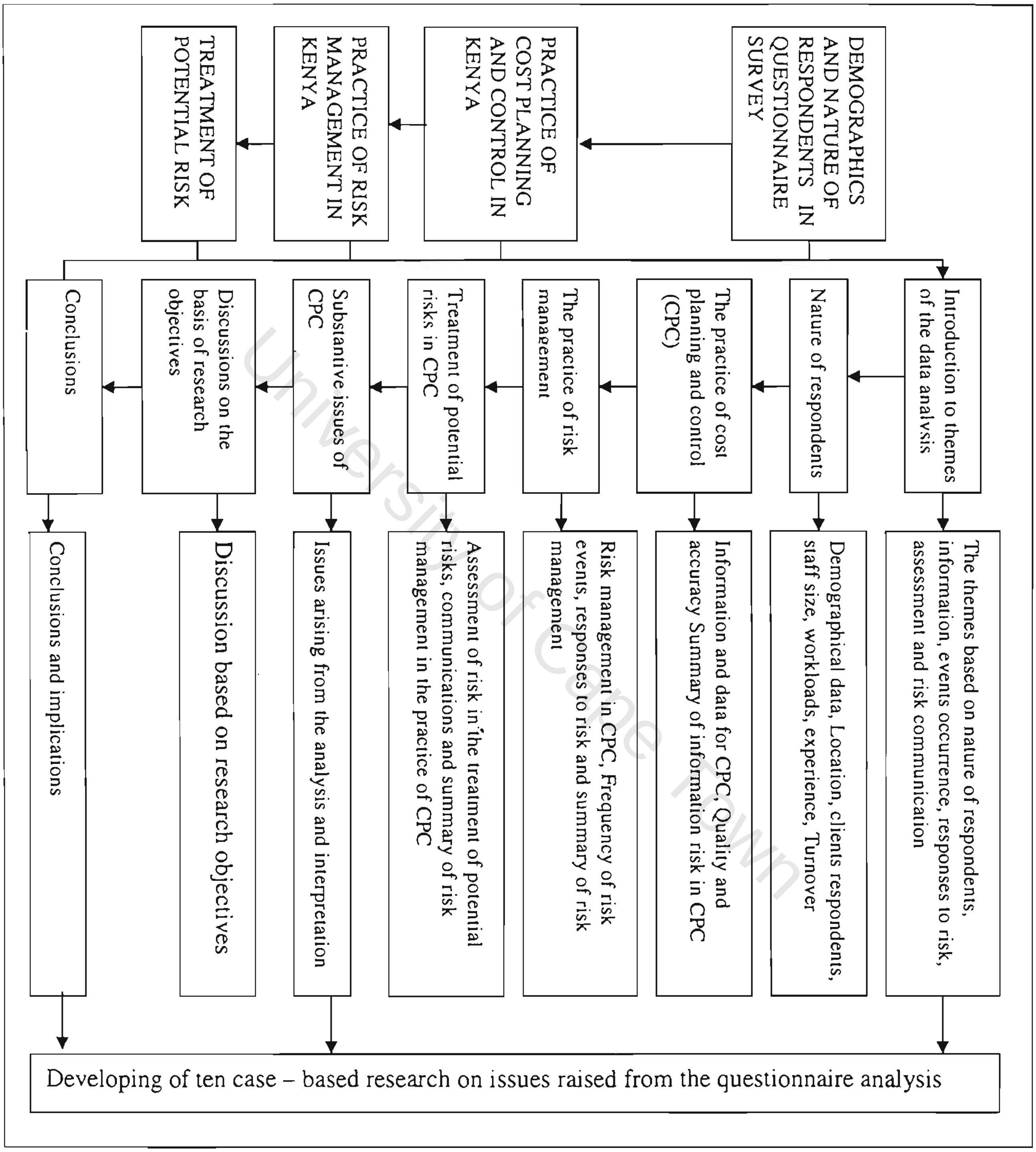

Figure 6.1 Hierarchical map of Chapter 6

6.2 Demographics and data of the research subjects

The literature, for example, Miller and Lessard (2001), Liu and Walker (1998), Handa and Adas (1996) and Kometa et al. (1995), identifies characteristics of clients and their consultants which they suggest facilitates effective cost planning, team building and risk communication in building projects. For this reason, the researcher decided to examine the nature of respondents and their projects.

The respondents' firms and organisations were of different sizes and operated in different regions, so it was necessary to establish their location and the nature of their projects. Furthermore, obtaining the demographics and data of the research subjects from the four respondent groups (clients, architectural, quantity surveying and engineering) was aimed at gaining insight into the respondents' firms and their projects (see Questions 1.1 to 1.6 for all groups). The results are discussed in Section 6.2.1 and tabulated in Tables 6.1 to 6.7, and a summary of the demographics and data is given in Section 6.2.2.

6.2.1 Nature of respondents and their organisations

6.2.1.1 Demographic data

This section of the questionnaire was aimed at obtaining the profile of the research subjects for the study; respondents were requested to provide information relating to their organisation and firms in three parts, namely the firm's location, the respondent's status and the staff size of the firms.

The rationale for selecting these three variables for examination in the study was that the building team of client, architect and engineer has several opportunities to discuss the entire project, and these three factors will influence this discussion and the resources devoted to the cost planning process (Ock, 1996).

6.2.1.2 Location

The survey was conducted over a large area to discount geographical bias that might occur. The study commenced by asking the respondents to indicate the geographic location of the firm (see Questions C 1.1, A 1.1, QS 1.1, E 1.1). Demographic data from the 192 completed and returned questionnaires were analysed to identify the nature of the respondents. A summary of the results is presented in Table 6.1.

Table 6.1 Location of the firm / organisation (Questions C 1.1, A 1.1, QS 1.1, E 1.1)

Geographic location	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Nairobi	25	42	38	27	132
Other	42	5	4	9	60
Total	67	47	42	36	192

Table 6.1 shows that the study did indeed have wide geographic coverage. An important point to note here is that over half (63%) of the clients are located outside Nairobi, but they are served by quantity surveying firms based almost entirely in Nairobi.

6.2.1.3 Clients' respondent status

In Question C1.2 the client respondents were asked to indicate their position in the client organisation and this was intended to find out their seniority in the construction industry. Moreover, by asking the respondent to indicate their position in the organisation, the researcher wanted the information obtained to be an indicator of experience in handling building funds. The information obtained on the position of the client respondents is reported in Table 6.2.

Table 6.2 Position of the client respondent in the organisation (Question C 1.2)

Position of respondent in management of building project	Number of client respondents
Financial controller	4
Project manager	27
M.D.	13
Proprietor	17
Other	5
Total	66
Missing / did not answer	1

The seniority of the various client respondents is indicative of their position on, and responsibility for building projects within their respective client organisation. Given that involvement in the financial management of projects is normally associated with such position of authority, it can be inferred that the client respondents have been exposed to issues of cost planning and control (and associated risk management) during their professional careers. For example, construction clients are exposed to cost planning by the Code of Practice (1985).

6.2.1.4 Staff size

Questions C1.3, A1.2, QS1.2 and E1.2 asked respondents to give the number of staff employed and involved in building work. A summary of staff categories is recorded in Table 6.3.

Table 6.3 Firms, organisations and their staff establishment (Q's C1.3, A1.2, QS1.2, E1.2)

Number of staff	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
1–5	3	20	28	6	57
6–10	11	16	8	7	42
11–25	21	7	4	6	38
26–50	24	0	0	6	30
> 50	5	1	1	10	17
Total	64	44	41	35	184

As can be seen from Table 6.3, there is a significant disparity among respondents. Of the architectural and quantity surveying firms, 45% and 68% respectively had not more than five members of staff, whereas nearly half of the client organisations had more than 25 staff and more than a quarter of the engineering firms had over 50 staff.

The implication of these results is that the small number of staff in architectural and quantity surveying firms could result in their having insufficient time, depending on workload, to prepare cost estimates. In the opinion of the researcher, this would account for the poor tender documentation experienced in construction industry (Akintoye and Fitzgerald, 2000). Tender documentation is discussed in more detail later in this chapter.

6.2.1.5 Workload

The source and type of workload determines the skills and working experience necessary for effective cost planning and risk management. Workload has been used as an indicator of the type of projects undertaken and the risks experienced in cost planning and control of building projects in Kenya. Respondents were assumed to have similar basic skills, and are all exposed to risk management in cost planning and control of building projects. Their reactions to questions were therefore expected to be based on similar working experiences and cost planning perceptions.

The investigation of the workload was broken down into three parts. This was expected to indicate the type of projects available in Kenya during the study period. The parts were:

- years of experience in the construction industry;
- gross annual turnover in respect of the value of projects;
- various project types as percentages of the total workload.

The rationale for adopting the first of these three sub-sections was that years of experience in the construction industry would be an important indicator of accumulated work experience for each firm or organisation. Construction organisations would have handled many projects and thus have a data bank to draw upon during cost planning. Quantity surveying firms would be expected to have a library of information that could be retrieved for use in estimating future buildings.

Gross turnover from the projects handled by firms and organisations in the Kenya building market would be used to reflect the sizes, in money terms, of projects that had been offered by clients to consultants to estimate their costs.

When investigating the sizes of projects it is necessary to know the type of project most frequently seen in the building market and for this reason the respondents were asked to indicate different types of projects as percentages of their total workload. Housing turned out to be the single most important component of the current investment in both public and private sector (see Table 6.7a below).

6.2.1.6 Experience

Risk management routines depend on a firm's risk perception, risk-taking routines and habits (Pablo, 1997), based on the years of risk experience that a firm has had with its building projects. The answers and categories of years of working experience are reported in Table 6.4 (see Questions C 1.4, A 1.3, QS 1.3, E 1.3). The number of years of experience in the construction industry gives a basis of reference for the financial risk exposures necessary when handling new building projects.

As can be seen from Table 6.4, a third of client organisations had over 21 years of construction experience and fewer than 10% had less than 5 years experience. This amount of experience was expected, because the study involved firms, organisations and clients who were registered with the relevant professional bodies in the building industry rather than being simply individuals' construction experiences.

Table 6.4 Years of experience in construction industry (Questions C 1.4, A 1.3, QS 1.3, E 1.3)

Years of experience	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
0–5	5	1	9	3	18
6–10	10	10	5	7	32
11–15	14	10	0	12	36
16–20	12	12	5	8	37
> 21	25	14	23	5	67
Total	66	47	42	35	190

The interpretation of the results was that the majority of client organisation, architectural, quantity surveying and engineering firms had many years of experience in construction projects. This confirmed the researcher's a priori assumption that these firms and organisations would have accumulated sufficient data for use in future cost planning.

The findings from Table 6.4 agree with those of Akintoye and Fitzgerald (2000), Pablo (1997) and Al-Momani (1996), who suggest that there is a lack of practical experience on the part of those responsible for the estimating function. Furthermore, according to Kaming et al. (1997) there was a lack of risk experience in different types of projects.

The agreement between the finding of this study and the existing literature could be due to two factors. First, projects are unique and financial risks are not necessarily repetitive. Even though firms might have adequate previous data and many years of construction experience, inaccurate estimation and cost plans could not be eliminated. Secondly, it appears that market price trends and project types change frequently, and cost practitioners are thus unable to use previous construction data to predict future building costs with certainty. Therefore, in the opinion of the researcher, estimating processes relying on previous construction data might be relatively ineffective in predicting building cost plans.

6.2.1.7 Turnover

Value determines the types of projects and their sizes in money terms, and this in turn determines the size of risk exposure in cost planning and control. The data given in Table 6.5 (see Questions C1.5, A1.4, QS1.4, E1.4) shows the size of projects handled by the respondent within the previous five years in the Kenya building industry. Gross turnover has been taken as an indicator of the size of projects offered to the building sector.

Table 6.5 Gross turnovers of respondents' projects (Questions C 1.5, A 1.4, QS 1.4, E 1.4)

Gross turnover in Kenya shillings	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
< 2 million	3	3	2	1	9
2.1–5.0 million	3	3	4	2	12
5.1–10 million	4	6	4	3	17
10.1–25 million	19	10	9	5	43
25.1–50 million	7	10	9	7	33
50.1–100 million	10	8	4	3	25
100.1–150 million	4	3	4	4	15
> 150.1 million	17	4	5	5	31
Total	67	47	41	30	185

Note: 75 Kenya Shillings was approximately equivalent to 1US$ at the time of this survey.

Table 6.5 shows that building activities had a typical distribution from small to large projects. Another implication is that the building cost consultants do have experience of risk, gained in planning and controlling building costs that require cost and risk management knowledge.

Table 6.6 Size of the current projects (Questions C 1.5, A 1.4, QS 1.4, E 1.4)

Size of current project	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
< 2 million Kenya shillings	10	12	10	6	38
2.1–5.0 million Kenya shillings	26	20	18	12	76
5.1–10 million Kenya shillings	31	15	13	12	71
Total	67	47	41	30	185

Data derived from an analysis of the information provided by respondents (in Questions C1.5, A1.4, QS1.4, E1.4) about the sizes of their current projects is reported in Table 6.6. This table depicts the possible ranges of categories of projects available for the study of cost planning and control practices.

Over 40% of the architectural and quantity surveying firms are involved in projects with a value ranging from KSh 2.1 to 5.0 million, and nearly half of the client projects ranged in value from KSh 5.1 to 10 million. This shows that small and medium projects made up the bulk of the respondents' construction work at the time of the survey.

6.2.1.8 Housing projects

The types of project handled determine the routine of risk assessment (see Pablo, 1997) and the respondents were requested to indicate the source of their current projects, and to indicate the percentage of the different project types that made up the total workload. In particular, Questions C1.6, A1.5, QS1.5 and E1.5 asked respondents to indicate the current value of their work, categorised in project types and given as a percentage of the total work. Note that these percentages do not summate to 100 since certain projects may be classified under more than one heading.

Table 6.7a Project type as percentage of workload (Questions C1.6, A1.5, QS 1.5, E1.5)

Project type	Given type as percentage of total projects				
	Client	Architectural	QS	Engineering	
Housing	69	76	74	60	
Renovation /Maintenance	55	59	48	50	
Commercial	55	52	50	45	
Engineering	46	35	15	45	
Industrial	40	35	26	33	
Other	9	–	20	10	

It is clear from Table 6.7a that, across all sectors of respondents, housing was the project type most commonly executed by respondent groups. Housing was therefore selected to be used as a representative project type for the purposes of data analysis and interpretation.

Table 6.7b, which is also based on Questions C1.6, A1.5, QS 1.5, and E1.5, records information on housing projects undertaken by the respondents as a percentage of their total workload.

Table 6.7b Housing workload (Questions C1.6, A1.5, QS 1.5, and E1.5)

Percentage of workload from housing	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
10%	7	6	2	9	24
20%	13	4	5	3	25
30%	9	7	3	5	24
40%	3	2	3	2	10
50%	2	5	7	0	14
60%	3	3	2	1	9
70%	0	5	3	1	9
80%	2	2	2	0	6
90%	2	1	1	2	6
100%	5	6	6	1	18
Total	46	41	34	24	145

Table 6.7b shows that all groups are to some extent involved with housing and that about 12% of the firms do exclusively housing work. For most businesses, however, housing constitutes less than half their work.

The implication of the results shown in Tables 6.6, 6.7a and 6.7b is that cost practitioners had not been exposed to large-scale risk management. The Kenyan building sector had not been active due to the poor economic conditions during the study period, and large investments in building works were very few in the Kenyan building market..

6.2.2 Summary of demographics and data of the research subjects

The majority of architectural, quantity surveying and engineering firms preferred to locate their offices in Nairobi while the client organisations had a wide geographic distribution within the different regions of Kenya.

The client respondents had senior positions in the construction industry, which is an indicator of seniority and the source of delegation of authority in project funding.

It appeared that the majority of quantity surveying and architectural firms were small and medium-sized practices, with a small number of staff members.

A majority of respondents had more than 15 years of construction experience, which indicated that client organisation, architectural, quantity surveying and engineering firms had many years of experience in construction projects.

The construction industry in Kenya had a reasonable distribution of small and medium-sized projects, and these made up the bulk of their building projects.

The value of majority of projects handled by respondents did not exceed 50 million Kenya shillings and therefore the type of risk exposure was particularly low in terms of large risk exposure in building projects.

In conclusion the demographics and data of the research subjects raised two issues:

How do firms and organisations handle lack of risk exposure to large-scale building projects?

What was the nature of the firms risk experience? Lack of large-scale project risk is common among cost practitioners and it is not surprising that the issue needs further clarification from the respondents on how they handle new projects.

6.3 The practice of cost planning and control in Kenya

In this section the practice of cost planning and control in Kenya is examined to establish the nature and extent of the service offered by the quantity surveyor in cost planning. The researcher noted that Cap 525 of the Laws of Kenya and the Code of Practice (1985) set out the cost planning and control procedures for the Kenyan construction industry. Cost planning and control procedures also follow established practices and principles established by Royal Institute of British Architects (R.I.B.A.) Plan of Work (1980). The practice of cost planning and control therefore has well-established procedures that are expected to be followed by quantity surveyors during the cost planning process.

Opinions were asked with regard to the practice of cost planning and control in Kenya (see Questions C2.7–2.12, A2.7–2.12, QS2.8–2.13, E2.7–2.12). This section reports on the information that was gathered. A selected summary of the data is presented below, under the following three headings:

- information and data risk in cost planning and control practices (section 6.3.1)
- quantification of risk in cost planning practice (section 6.3.2)
- accuracy risk in cost planning and control practice (section 6.3.3).

In addition, a summary of the practice of cost planning and control in Kenya is given in Section 6.3.4.

The rationale for presenting the results in these three sections is that in the literature (e.g. Kim and Bajaj, 2000) cost assessment is shown to begin with identifying the risks in the project. This identification process starts by obtaining information and data regarding potential risks (see e.g. Chapman, 2001).

The second step is the selection of cost significant risks for evaluation and assessment (i.e. quantifying project information) (Ward, 1999). In the literature (e.g. Ock, 1996) on quantifying risk, this step is said to be finalised by quantifying the risks in terms of degree of uncertainty and magnitude of consequence (Kim and Bajaj, 2000). For this reason the researcher decided to examine the information and data risk associated with identifying process and quantifying risks in cost planning.

Lastly, the researcher examined received data on accuracy risk in cost planning and control. The inaccuracy of cost estimates has been recognised by other researchers (e.g. Akintoye and Fitzgerald, 2000) as an area in which estimators have little knowledge and therefore the researcher wanted to establish the nature and extent of accuracy risk in cost plans.

A summary is presented at the end of the section to show what has been gained from the study of the practice of cost planning and control in the Kenyan building sector.

6.3.1 Information and data risk in cost planning practices

Akintoye and Fitzgerald (2000) and Al-Momani (1996) noted that in general there was a lack of adequate cost and risk planning information in the construction industry in the UK. Quantity surveyors need project information and data from the building market in order to perform their function of cost planning and control.

This section presents a summary of the data analysed from project cost information and from cost planning and control practices. In Questions C2.5–2.12, A2.5–2.12, QS2.5–2.9 and E2.5–2.12, respondents were asked to choose from a list of common practices. The data collected was analysed and is reported in Section 6.3.1. To make Section 6.3.1 clear to the reader the responses are summarised and reported in four parts, namely:

- data analysis of information data risk
- receipt of first budget information

- information for establishment of the budget for the client
- information on cost planning concepts and practices.

The reason for selecting the first of these four sub-sections was that cost planning involves checking for the existence of risk through data analysis of the information available. This data analysis helps the quantity surveyor to analyse and assess sources of risk and to refine initial estimates from the client. The second sub-section was chosen because the quantity surveyor has to produce first budget information based on qualitative information, to form a guide to the client's own expenditure plans on capital funds. Therefore, the receipt of the first budget advice from the quantity surveyor is essential in understanding a project's cost objectives. After knowing the likely extent of the project expenditure, it is necessary to review and reconcile the estimated cost plan with the client's capital funding, which is why the information for the establishment of the budget for the client was selected. Lastly, information on cost planning concepts were sought because different clients have different cost planning needs, such as having a formal plan to deal with project risks.

6.3.1.1 Data analysis of information data risk

The questions relating to information and data risk asked respondents for information regarding the checking of the estimate against the cost plan (cost budget estimate) at different stages of project development (see Questions C2.10, A2.10, QS2.9, E2.10). Data on respondents' opinions were summarised as 'data analysis of information data risk'.

This sub-section reports on important cost risk variables from an information and data viewpoint. The literature (e.g. Pender, 2001; Kartam and Kartam, 2001) shows that the quality of information affects the budgeting process and thereafter budget prediction.

Ten variables considered by the researcher as important to cost planning. The basis for selection was their significance contribution to cost as determined by respondents from a total of 23 cost variables affecting budget prediction and are tabulated in Tables 6.8 to 6.17 to represent the information and data risk theme. The choice of these ten most-indicated variables was expected to enable the researcher to establish the nature and extent of cost planning practice relating to the lack of adequate information and data on which to base estimated cost plans.

6.3.1.2 Receipt of first budget information

Pedwell et al. (1998) and Morrison (1983), writing on the cause of budget failures, have noted that poor front-end cost planning in the early stages of a project was the cause of ineffective cost planning, in particular when the practitioner acts as a passive receiver of building information.

The Code of Practice (1985) requires that the quantity surveyor be appointed at an early stage of the project. The first budget could be produced at different stages of a project, but the most important guides for cost planning of a project would be at feasibility and detail design stages. In the literature (e.g. Morrison, 1983) it is shown that the stage at which information is produced and received affects cost planning. For example, first cost plans are affected by the stage at which information is received, to establish the budget for the client. For this reason this sub-section attempts to investigate the flow of the budget information in two parts: first cost plan and detailed cost plan. The reason for selecting these two cost estimates from the quantity surveyor was that first cost is essential in setting the initial capital funding, and the detailed cost plan is the basis for the cost control of building design and for checking and reconciling tenders.

Tables 6.8 and 6.9 record the information received from the respondents on first cost plan at feasibility stage, and detailed cost plan at detail design stage.

6.3.1.3 First cost plan

Clients, architectural, quantity surveying and engineering firms were asked (see Questions C 2.7, A 2.7, QS 2.8, E 2.7) to indicate the stage at which information relating to the cost budget was first received from the quantity surveyor or first produced by them.

Table 6.8 First budget information receipt at feasibility stage (C 2.7, A 2.7, QS 2.8, E 2.7)

First budget at feasibility stage	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom or never	11	9	17	11	31	48
Occasionally	26	19	12	11	56	68
Always	20	13	8	4	37	45
Total	57	41	37	26	124	161

The information collected from the question was intended to be an indicator of cost planning practices offered by the quantity surveyor when establishing the budget for the client.

Most of the receiving respondents (client, architectural and engineering) only occasionally obtained the first cost budget on the project at feasibility stage and a quarter (31 out of 124) said that they seldom or never received it by this stage. Client firms appear to receive the first budget at this early stage more often than architectural or engineering firms do. Here it can be noted that nearly half of quantity surveying firms said that they seldom or never produced the first cost plan at this stage.

The researchers' interpretation of these results is that the professional building cost consultant waits for more detailed project before producing the first cost plan. Another interpretation could be that the quantity surveyors are not engaged to prepare a cost plan until later in the process.

6.3.1.4 Detailed cost plan

Since cost has to follow design, particularly when following a costing-a-design procedure, the preparation of the project budget does not start before detail design stage. Receiving respondents (clients, architects and engineers) were asked in Questions C2.9, A2.9, QS 2.7 and E 2.9 to indicate at what stage of the project they receive the detailed cost plan from the quantity surveyor, and quantity surveying firms were asked at what stage they first establish a budget for the client. Table 6.9 reports on the stage that respondents produced or received detailed cost plans. The detail design stage was chosen from the analysis to illustrate the current situation relating to the experiences of the cost plan receivers.

Table 6.9 Detailed cost plan receipt at detail design stage (Questions C2.9, A2.9, QS 2.7, E 2.9)

Detailed cost plan at detail design	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom / never	13	5	5	7	25	30
Occasionally	26	13	9	11	50	59
Always	16	26	16	16	58	74
Total	55	44	30	34	133	163

Just over half of the quantity surveying firms first established the budget for the client at detail design stage, and nearly half of those receiving the information (47%) said that they always receive the first detailed cost plan at detail design stage, with another 38% indicating that they at most occasionally receive it by that time.

The researcher's interpretation of these results – detailed cost plan being received after detail design stage – is that this is not an effective practice of cost planning.

6.3.1.5 Information on establishment of the budget for the client

Some authors, for instance, Pedwell et al. (1998) and Samid (1996), argue that the best stage to receive cost plan and control building cost would be at project inception. The preceding analysis was intended to show the contradiction in the cost planning and control practices used by the quantity surveyor to establish the budget for the client. A question that arose from practice was whether the quantity surveyor intended to establish the clients' budget at inception, detail design or at tender stages. Thus the following section deals with receipt of first budget advice as cost plan information starts to flow in from the quantity surveyor. Three stages of project development using cost information from the quantity surveyor are seen by the researcher as most important; these are the project inception, detail design and tender stages.

The rationale for investigating these three stages in the establishment of the client's budget is that, before a cost plan is developed, risks have to be identified so that they can be assessed and incorporated into the estimates. Therefore it is sensible to examine cost plan at project inception.

Secondly, as the project develops, it is wise to review data on risks, and the detail design stage would be an appropriate place to do this.

Errors on the estimated cost plan can be corrected and in the opinion of the researcher, the tender stage is actually too late for the estimate to be adjusted by the building team.

Thus, these three stages of project construction were selected to represent the stages at which a cost plan would be most useful in guiding project development.

6.3.1.6 First budget advice at inception stage

Quantity surveyors' cost information is essential for establishing a cost plan. Questions C2.6, A2.6, QS2.7 and E2.6 requested the receiving respondents to indicate the stages at which information was received from the quantity surveyor to establish their budget.

Table 6.10 Establishment of first budget advice at inception stage (Q's C2.6, A2.6, QS2.7, E2.6)

Establishment of QS advice at inception	**Number of respondent firms and organisations**				Total without QS	Total with QS
	Client	**Architectural**	**QS**	**Engineering**		
Seldom or never	10	20	8	13	43	51
Occasionally	19	12	6	7	38	44
Always	26	7	20	6	39	59
Total	55	39	34	26	120	154

illustrate current practices in establishing a cost plan. Table 6.12 presents the information gathered on the same.

Table 6.12 Receipt of first budget advice at tender stage (Questions C2.6, A2.6, QS2.7, E2.6)

QS advice at tender	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom/never	9	7	8	5	21	29
Occasionally	25	4	4	10	39	43
Always	25	25	19	12	62	81
Total	59	36	31	27	122	153

In Table 6.12, a majority (61%) of quantity surveying respondents reported that they always establish the budget for the client at tender stage. Nearly a fifth (17%) of respondents said that they seldom received this advice, even at the late tender stage. Architectural firms receive first budget advice / information at tender stage more often than clients or engineers do.

The implication of the results from Table 6.10 to 6.12 was that the first detailed cost plan was received from the quantity surveyor only at a late stage thereby reducing its intended effectiveness in controlling building cost.

The researcher's understanding is that the quantity surveyor wishes to be appointed at early project development stages but sometimes this does not happen as he or she is appointed late in the life of the project. At tender stage all the information necessary for the production of a first budget is available and that is why Table 6.12 shows that the majority of quantity surveyors reported that they always establish the project budget at tender stage. The quantity surveyor responses were in agreement with those of architectural firms who indicated that they receive first budget information at tender stage because that is the stage at which they need to use the estimated cost plan against received bids. The results showed that the estimated cost plan is no longer serving its originally intended purpose as a project development guide.

It is therefore the opinion of the researcher that, due to the late start of quantity surveying functions, Kenyan quantity surveyors are largely forced to abandon cost planning for future development, and instead become cost controllers.

6.3.1.9 Information on cost planning concepts and practices

The following five tables illustrate respondents' awareness of cost planning and control concepts; they are intended as an indicator of current cost planning practices offered by the quantity surveyor in Kenya. This is important because the significance of the stage at which the quantity surveyor produces information to establish the first budget depends on whether respondents are aware of the concepts of cost planning.

The issue of information on cost planning concepts and practices was examined, to establish the nature and extent of awareness of cost planning concepts. This was done in two parts, the first dealing with the cost planning awareness of the client respondents. Secondly, the practice of cost planning was examined to ascertain the stage at which the receivers of cost plans receive cost advice. The rationale for selecting these two issues for examination was that they reflect the quality of service received from the quantity surveyor during the cost planning process.

6.3.1.10 Client cost planning awareness

In order to obtain an indication of client awareness of current cost planning practices, Question C2.5 was selected, in particular the section which asked whether clients were aware of cost planning. This was aimed at revealing the clients' perceptions of cost planning practices. The clients were not expected to know cost planning concepts but display an awareness of the procedures detailed in the Code of Practice (1985). The results are given in Table 6.13. (Note: there was no corresponding question for architects or engineers).

Table 6.13 Cost planning and control concepts (Question C2.5)

Awareness of cost planning concepts	Number of client respondents
No	20
Yes	40
Total	60

As indicated in Table 6.13, only two thirds of client respondents were aware of the concepts of cost planning and control.

6.3.1.11 Receipt of the detailed cost plan

A further explanation on detailed cost planning was sought by Questions C2.9, A2.9 and E2.9, which was intended to give insight into risk perception of service receivers and users regarding the stage at which the detailed cost plan is received from the quantity surveyor.

If a cost plan is received in the late stages of project development, the assessed cost and budget prediction might not effectively guide project design and development. Table 6.14 gives the data for one stage (tender stage) at which cost plan users receive a detailed cost plan. Since this is the final stage, it is essential for good planning that detailed costs be established by this time of the project development.

Table 6.14 Detailed cost plan at tender stage (Questions C2.9, A2.9, and E2.9)

Receipt of detailed cost at tender stage	**Number of respondent firms and organisations**			Total
	Client	**Architectural**	**Engineering**	
Seldom	11	4	10	25
Occasionally	16	5	11	32
Always	28	23	9	60
Total	55	32	30	117

The majority of client organisations and architectural firms first received the detailed cost plan from the quantity surveyor only at tender stage. Table 6.14 shows that fully one third of engineering firms seldom or never received a detailed cost plan, even at tender stage, although they might by this time have received first budget advice.

6.3.1.12 Checking estimated cost against cost plan

One of the activities of cost planning is to monitor planned expenditure in order to control the cost of building projects. This might be done at any of three stages of construction, selected on the basis of importance to cost planning practice. These are, as before, feasibility, detail design and tender stages.

The basis for the selection of these three stages of building construction in the investigation of checking the estimated cost against the cost plan was firstly because the R.I.B.A. Plan of Work (1980) suggests stages at which checking of the estimate would be advisable in establishing of cost guidelines. Secondly, at feasibility stage the quantity surveyor is expected to check whether the client's budget was adequate for the intended purpose and then advise the client on any necessary corrective action. Thirdly, at detail design stage the quantity surveyor would be expected to have identified all potential risks in the project and to have developed plans for dealing with them. He or she can only do that by checking the estimated cost against the developed cost plan. Finally, the tender stage was selected for its importance to tender analysis and as a final check on the cost of the project.

Checking cost evaluation is essential to reconcile clients' capital funds. The following three tables report on the checks done in order to cost plans against the budgeted estimates. Following the R.I.B.A. Plan of Work (1980), Questions C2.10, A2.10, QS2.9 and E2.10 asked for information on cost checking at different stages of a project.

6.3.1.13 Cost checking at feasibility stage

Financial allocation and the future project estimates are regarded as important components of good cost planning practice and therefore the information sought was intended to examine the extent of cost checking carried out by the quantity surveyor during cost planning.

Table 6.15 Checking estimates at feasibility stage (Questions C2.10, A2.10, QS2.9, E2.10)

Checking cost plan at feasibility	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom or never	15	13	23	9	37	60
Occasionally	19	16	6	14	49	55
Always	19	8	5	5	32	37
Total	53	37	34	28	118	152

The results shown in Table 6.15 indicate that more than two thirds of respondents seldom or never check the estimate against cost plan at feasibility stage. Receiving respondents also seemed to do relatively little in the way of making this check, although client respondents did so more often than architects and engineers. The reason that clients seem to be interested in checking the cost plan more often than other respondents might be because it is their money and they would like to know how it is going to be spent by the building team. The financial managers training, which emphasises general financial management might be a factor of influence in checking the projects' cost plans. The lack of checking by others may be due their not being aware of its importance.

6.3.1.14 Cost checking at detail design stage

Checking cost estimate at detail design stage is good practice because the reconciliation of cost plan against the anticipated final building cost is carried out before tenders are issued. The checking of estimated cost at detail design stage is shown here because it represents budgeting activity taking place before the work is finally sent out to the contractors. The information gathered from the respondents in Question QS 2.9 and C2.10, A2.10 and E2.10 is recorded in Table 6.16.

Table 6.16 Checking cost at detail design stage (Questions C2.10, A2.10, QS2.9 and E2.10).

Checking cost at detail design	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom or never	13	5	2	4	22	24
Occasionally	26	13	8	8	47	55
Always	16	26	30	20	62	92
Total	55	44	40	32	131	171

Just under half of the receiving respondents said that they always check the estimated cost at detail design stage, and a further 36% do usually do this check, though clients do it less often than engineers and architects – in fact over half of architectural and engineering firms check the estimated cost against the cost plan at this stage. Three quarters of quantity surveying firms indicated that they check the estimated cost against the cost plan at detail design stage.

The breakdown shown here indicates that three-quarters of the quantity surveyors do cost checks regularly. Clients (47%) seem to check estimated cost less often than the other respondents; this is possibly because they expect this to be done by the quantity surveyor.

6.3.1.15 Cost checking at tender stage

At tender stage the ideal practice would be to check budget prediction against the anticipated cost at detail design stage. It is generally considered in the literature (e.g. Morrison, 1983) that the checking of cost plan should be done before tenders are received back as the cost might exceed the budget without the design team being aware of this fact, especially when design variation was not expected at the construction stage.

Lastly, tender stage is the stage in project development at which it was thought necessary by the quantity surveyor to check information against the cost plan (see Code of Practice, 1985). The information gathered on the checking of estimates against cost plan at tender stage is recorded in Table 6.17.

As can be seen from this Table 6.17, a majority of all respondents always checked the estimated cost against cost plan at the tender stage, though surprisingly almost 20% indicated doing this only 'occasionally', and a further 12% said that they seldom or never check it.

Table 6.17 Checking cost at tender stage (Questions C2.10, A2.10, QS2.9 and E2.10)

Checking cost at tender stage	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom / never	3	3	4	4	10	14
Occasionally	17	8	3	4	29	32
Always	37	28	29	22	87	116
Total	57	39	36	30	126	162

In this section a summary of the provision and nature of building information and the data used in the cost planning process was provided. In the next section (Section 6.3.2) the nature and practice of quantifying information and data in cost planning and control is examined.

6.3.2 Quantifying risk in the practice of cost planning and control

This section examines quantifying risk in the cost planning process. Quantifying risk generally provides an in-depth understanding of the sources and degree of risk. Two papers, by Love and Li (2000) and Ock (1996) by have argued for the quantifying of information by identifying the causes, cost and magnitude of risk in the provided data. Risks identified in the building process must be quantified in terms of degree of uncertainty and magnitude of consequence (Kim and Bajaj, 2000). The quantifying of risk represents an acknowledgement of the difficulties in quantifying information, due to imprecise or incomplete knowledge (Pender, 2001). Errors of judgement and interpretation may arise from incomplete design details, or from the estimator using poor quality information in quantifying the data. The examination of the quantifying process in this research is aimed at establishing the nature and extent of quantifying risk in the cost plan.

The analysis within the quantifying risk theme is conducted in five sub-sections that were mainly derived from different approaches adopted in the risk evaluation and assessment process, namely:

- data analysis of quantifying risk in cost planning and control practice
- the adopted quantifying techniques
- documenting the contract

- perception of importance of the estimated cost
- current practices of cost planning and control.

The first step in selecting the variable for examination is to identify the risks. This is done through data analysis to find out the significant risks among the many that affect a building project. The second step is to decide on the method to use in assessing the risks. This step is concerned with developing an approach for determining the size of a risk by selecting one of the various methods of risk evaluation from traditional to conceptual models. In making the decision to evaluate risk, sufficient numerical information is either made available through units of measurement or through statistical characterisation of the risk factors. The risk management literature recognises that qualitative factors may be used in evaluating the risks (see e.g. Kangari and Riggs, 1989).

The third step in the quantifying process relates to project character and future revenue. The project character and its revenue are fundamental in quantifying of risk because risk assessment is designed on the basis of quantified results (Ock, 1996). Senior (1990) believed that the success of any agreement is wholly reliant upon the needs of the parties involved, and it is more than likely that current practices of cost planning and control would be used by the practitioner to satisfy the financial requirements of the client (White and Fortune, 2002).

The quality of cost planning and control services is influenced by the way in which drawings are converted into measurements (Kim and Bajaj, 2000). Respondents' opinions on measurement and quantifying practices were surveyed in Questions C1.7, A1.6, QS1.6, E1.6 to C2.5, A2.5, QS2.6 and E2.5.

6.3.2.1 Data analysis of quantifying risk in cost planning and control practice

In this sub-section an overview of quantifying data in the cost planning and control process is presented. According to the literature (e.g. Mok et al., 1997), for cost planning purposes, it is not only necessary to establish the methods of quantifying data used but also to ascertain the stage at which the quantity surveyor is appointed to the project. This sub-section is aimed at determining the nature of the problems faced by client, architectural, quantity surveying and engineering firms in the quantifying of risk, and the firms' perceptions of the importance of a quantified cost plan.

An examination of risk quantifying was done in an endeavour to establish its nature and extent in the cost planning process. Of the 28 quantifying variables given in the questionnaire, only eleven – relating to problems of measurement in cost planning practices – were selected for examination in this section. The reason for selecting these eleven variables is that, in the preliminary analysis, the respondents indicated these variables as having a significant effect on estimated cost plans. The information gathered is reported in Tables 6.18 to 6.29.

6.3.2.2 The type of estimating or measurement method used

The type of estimation or the measurement method used in the cost planning process would depend on the quantifying technique adopted. It is generally accepted (see e.g. Code of Practice, 1985) that building information is first transformed into measured units for purposes of risk allowances through the building activity because every activity has its own risks that make its future uncertain (Ock, 1996).

A building activity is a controllable activity into which a project can be divided in accordance with the size of that project (Ock, 1996). Breaking down the project into its constituent activities may help the risk analysis and assessment processes. A risk-associated activity cannot be accurately estimated because of uncertainties in construction and the different building activities taking place on a site. Quantifying the issues of building risk would therefore help in the examination of the data stemming from each building activity (Kim and Bajaj, 2000). By focusing on these building activities, understanding of the contribution that risk management makes to estimating cost plans might be enhanced in cost planning processes. In this way building activities would be converted into costs through quantifying the available information and drawings.

On large building projects in Kenya it is common for clients to appoint a quantity surveyor as cost advisor. The role of the quantity surveyor in the provision of cost advice is largely a function of client type and experience, as in the form of building contract selected. In turn, the nature and complexity of the project, coupled with the client's objectives in undertaking the project, influences the selection of an appropriate building procurement method. Clearly, the influence of the quantity surveyor in the provision of cost advice is a direct function of the stage at which he or she is appointed. The quantity surveyor can only take responsibility for the economics of a building design if he or she has been involved in the design process from the outset (Dell'isola, 1998).

To establish the nature and extent of current practices in building procurement, respondents were asked for their opinions on the contract procurement process and the appointment of a quantity surveyor. The information gathered from the respondents was aimed at interpreting the level of cost planning service offered by the quantity surveyor.

The examination of the appointment of a quantity surveyor was conducted in two parts, namely the frequency of appointment of a quantity surveyor, and the use of selected tender in contract procurement.

The rationale for selecting these two variables is that it is important to appoint a quantity surveyor early enough to undertake initial cost planning of the project. Most of the detailed analysis of the building information for the purpose of cost planning is determined by the type of client and the intended contract procurement method for the project. Some project procurement methods do not require detailed cost advice as the contractor is expected to undertake all the necessary cost calculations at his or her own cost outside the contract. Thus the researcher decided to examine the two variables due to their influence on cost details produced in the planning process.

6.3.2.3 Frequency of quantity surveyor appointment

The first variable to be examined under the adopted quantification technique was the frequency of quantity surveyors' appointment in the building project. This was done in order to establish the quality of service offered by the quantity surveyor. For this reason the researcher decided to examine, firstly, the practice of appointing a quantity surveyor based on receivers' of cost plans point of view. Questions C2.1, A2.1 and E2.1 asked the respondents to indicate whether a quantity surveyor was always, occasionally or seldom appointed in their building projects. The answer to this question was intended to be an indicator of awareness of good financial management practice. The information obtained is tabulated in Table 6.18.

Table 6.18 Frequency of appointing quantity surveyor (Questions C2.1, A2.1, E2.1)

Client appointment of QS	Number of respondent firms and organisations			Total
	Client	Architectural	Engineering	
Seldom/never	7	24	4	35
Occasionally	20	0	18	38
Always	32	22	13	67
Total	59	46	35	140

Only 48% of respondents reported that a quantity surveyor was always appointed to the project, and another 27% of clients did so only occasionally. Just over half of the architectural firms seldom or never appoint a quantity surveyor for their projects. The engineers reported that they occasionally appoint a quantity surveyor, therefore creating a negative bias in the data shown. Over half (54%) of the client respondents frequently appoint a quantity surveyor for their projects. This was surprising to the researcher as it was a contradiction of the expected close working relationship between architect and quantity surveyor. Moreover, the early appointment of a quantity surveyor facilitates a direct relationship of the parties with the cost of the project.

The question that then arises is: In the absence of the quantity surveyor, who assumes responsibility for cost planning and cost control?

6.3.2.4 Use of selected tender method

The second variable examined under the adopted quantifying technique sub-section was the use of selected tender in the building procurement process. The selected tender procedures in contract procurement commit the parties to a contract using bills of quantities as a basis of contract documentation. Thus the selected tender process needs quantified information for the bills of quantities before tenders are invited.

This examination was aimed at obtaining data on practices used by respondents to enhance cost plans. The quantity surveyor, once appointed, helps the building team to quantify the needs of the client in terms of the building cost plan and the costing of the design. However the client has a great influence on the type of cost details required from the quantity surveyor, particularly regarding the type of estimate and the stage at which to start the planning process. The quantity surveyor in turn makes the client understand the cost implications of the project development activities. For this reason Questions C1.7, A1.6, QS1.6 and E1.6 attempted to establish the respondents' preferences in the procurement systems adopted for the project development.

It is generally considered in the literature (e.g. Senior, 1990) that the contract procurement process is chosen on the basis of its compatibility with competitive tender methods. Of the contract procurement methods, the 'selected tender' method is a controlled representative sampling of the suitable contractors and can be made competitive.

Questions C1.7, A1.6, QS1.6 and E1.6 requested respondents to indicate which procurement methods (open tender, selected tender, negotiated contract, other) they had used over the previous three years. Table 19a shows the responses (Note that the percentages in each column add up to more than 100 because respondents chose more than one method.).

Table 6.19a Distribution of different tender methods (Questions C1.7, A1.6, QS1.6, E1.6)

Tender method	Tender methods used over three year period				Total
	Client	Architectural	QS	Engineering	
Selected tender	52	45	36	24	157
Open tender	52	28	29	27	136
Negotiated contract	38	42	24	21	125
Other	10	20	–	4	34
Total	152	135	89	76	452

As can be seen from Table 6.19a, there was a fair spread in the use of the three main procurement methods, but selected tender was the most common choice with all groups except the engineers, and only a few 'other' methods were mentioned.

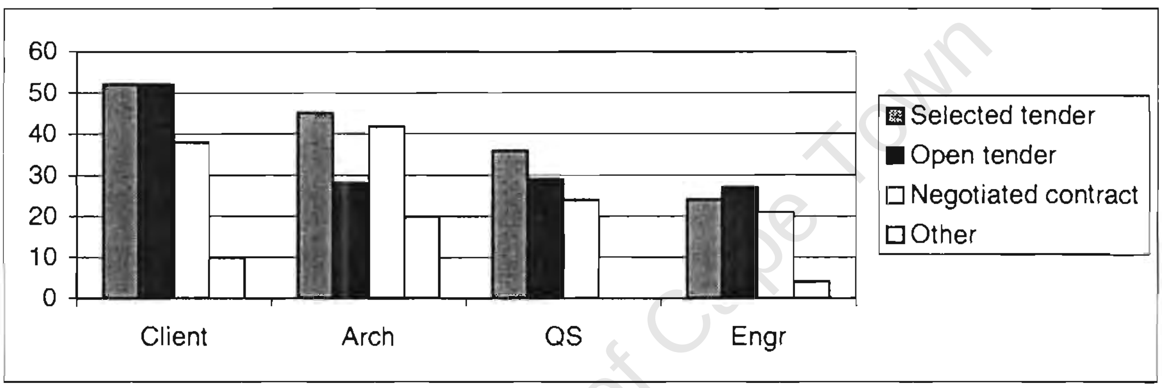

Figure 6.2 Project procurement system utilitisation

Figure 6.2 shows the same data. Because selected tender was the most common procurement method, it has been used in the detailed breakdown of workload given in the next table (Table 6.19b).

Table 6.19b gives the breakdown of the work executed using the selected tender method as a percentage of the total workload. As explained above, the other tendering methods have been omitted for the purposes of clarity in the data analysis. Figure 6.2 below shows the same data.

Table 6.19b Use of selected tender in project procurement (Questions C1.7, A1.6, QS1.6, E1.6)

Distribution of selected tender method as % of total workload	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
10%	9	12	4	3	28
20%	6	4	1	4	15
30%	18	4	2	5	29
40%	2	4	1	2	9
50%	5	5	0	2	12
60%	3	6	6	1	16
70%	0	3	4	1	8
80%	4	5	9	2	20
90%	0	2	4	1	7
100%	5	0	5	3	13
Total number using selected tender	52	45	36	24	157

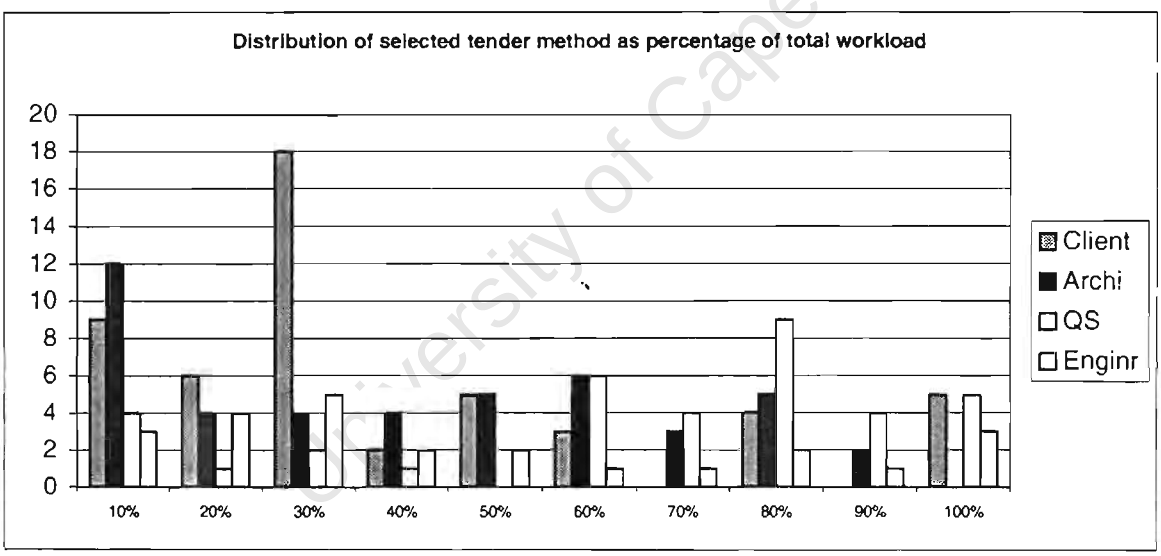

Figure 6.3 Distribution of project procurement system in particular the selected tender method.

Tendering procedures are usually decided in advance and some methods have advantages over others. For example, the negotiated tender gives the quantity surveyor an opportunity to negotiate in advance of the project design; selected and open tender both require completed drawings, and in addition the open tender process is difficult to monitor.

6.3.2.5 Documenting the contract

In this sub-section the preferred documentation for the contract procurement is examined, to establish the nature and extent of the quantification method preferred by the quantity surveyor. The quantifying process is important in understanding building expenditure through the estimated cost plan. It is evident from the literature (e.g. Bowen, 1993) that quantity surveyor involvement in the early development stages was generally minimal. It was therefore necessary to know the type of documents used by the quantity surveyor to guide the planning of the project cost.

The provision of cost planning services was seen as a primary function, particularly in the use of the bills of quantities to estimate the cost of the future building. This section was therefore aimed at establishing the nature and extent of the cost planning and control by examining the provision of bills of quantities and the appointment of the quantity surveyor.

6.3.2.6 Use of bills of quantities at tender stage

The first variable to be selected for examination in documenting the contract was the use of bills of quantities at tender stage. The respondents were asked their opinions on the type of documentation used in their building projects.

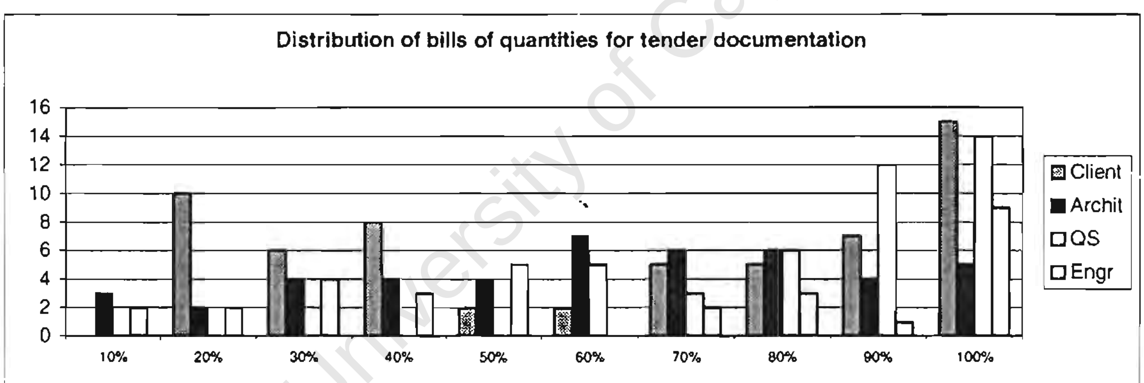

Figure 6.4 Distribution of bills of quantities method for tender documentation.

Questions C1.8, A1.7, QS1.7 and E1.7 in particular requested respondents to indicate the type of documentation used in their project procurement over the past three years. The results obtained are summarised in Table 6.20.

Table 6.20 Bills of quantities method in contract procurement (C1.8, A1.7, QS1.7 and E1.7)

Distribution of bills of quantities for tender documentation	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
10%	0	3	0	2	5
20%	10	2	0	2	14
30%	6	4	0	4	14
40%	8	4	0	3	15
50%	2	4	0	5	11
60%	2	7	5	0	14
70%	5	6	3	2	16
80%	5	6	6	3	20
90%	7	4	12	1	24
100%	15	5	14	9	43
Total number using bills of quantities	60	45	40	31	176

Table 6.20 shows the preference for use of bills of quantities in project documentation in the contract procurement process for building works. A quarter of the respondents always used bills of quantities as the basis of project documentation in the contract. A striking feature of these results is that all quantity surveying firms reported using bills of quantities in at least 60 % of their project contract procurement cases, and 65% of them used bills of quantities 90% or more of the time.

It appears that the bills of quantities method was very frequently used for project documentation in the contract procurement process, depending on the size of the project (see Figure 6.3). The finding appears to be in keeping with the literature (e.g. Uher, 1996). The use of the bills of quantities method in project documentation is seen by the quantity surveyor as a solution to the lack of adequate information on which to base future cost prediction (Brandon and Newton, 1986). If adequate time and information was provided bills of quantities would be the basis of cost planning. However, the bills of quantities method places limitations on the cost planning process due to the large number of cost items (Uher, 1996).

6.3.2.7 Early appointment of the quantity surveyor

Table 6.20 shows that all responding quantity surveyors regarded the bills of quantities method as suitable for selected tender. It would therefore be expected that the quantity surveyor who carries out such an obligation would be appointed as a first priority, before the procurement method was decided upon. Questions C2.3, A2.3, QS2.1 and E2.3 thus attempted to examine the stage at which the quantity surveyor was appointed in order to start off the quantifying process by the bills of quantities method. The information collected is recorded in Tables 6.21 to 6.23.

6.3.2.8 Appointment of the quantity surveyor at inception stage

The second variable to be examined in this sub-section was the quantity surveyor's appointment at the inception stage. This was aimed at finding out client awareness of cost planning practices. Questions C2.3, A2.3, QS2.1 and E2.3 asked the respondents to indicate, for each stage in the project, how frequently the quantity surveyor first became appointed at that stage.

The Code of Practice (1985) and the R.I.B.A. Plan of Work (1980) indicate that the appointment of the quantity surveyor should, ideally, be carried out at project inception. The appointment of the quantity surveyor at inception stage was thus selected by the researcher as a guide to project development. The results of C2.3, A2.3, QS2.1 and E2.3 are recorded in Table 6.21.

Table 6.21 Quantity surveyor's appointment at inception stage (Questions C2.3, A2.3, QS2.1, E2.3)

QS appointment at inception stage	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Seldom	12	12	4	11	39
Occasionally	17	14	18	5	54
Always	24	13	14	14	65
Total	53	39	36	30	158

Table 6.21 shows that about 41% of respondents said, with fair consistency across the four categories, that they always appointed a quantity surveyor at project inception. There was, however, less consistency across the 'seldom' category with the opinions of the quantity surveyors showing a far lower figure than that given by the other respondents. In other words, the quantity surveyors' opinions about how early they were appointed did not agree with the opinions of those using their services.

6.3.2.9 Appointment of the quantity surveyor at detail design stage

In the third part of documenting the contract, the appointment of quantity surveyors at detail design stage is examined. This examination was aimed at establishing information about an alternative stage at which the quantity surveyor might be appointed. The results are recorded in Table 6.22.

Table 6.22 Quantity surveyor appointed at detail design stage (Questions C2.3, A2.3, QS2.1, E2.3)

QS appointment at detail design stage	Number of respondent firms and organisations				Total without QS	Total with QS
	Client	Architectural	QS	Engineering		
Seldom	14	4	5	5	23	28
Occasionally	22	15	10	9	46	56
Always	16	16	17	14	46	63
Total	52	35	32	28	115	147

Table 6.22 shows that 40% of the 'receiving' respondents said they always appointed a quantity surveyor at the detail design stage, while another 40% indicated that a quantity surveyor was occasionally appointed at detail design stage.

The researcher is of opinion that these results show that cost practitioners considered it important for the quantity surveyor cost plan to be received by detail design stage, though not before that.

6.3.2.10 Appointment of the quantity surveyor at tender stage

Finally, the researcher examined the quantity surveyor appointment at tender stage, using the aforementioned Questions C2.3, A2.3, QS2.1 and E2.3. The results are given in Table 6.23.

Just over half of the respondents always appointed a quantity surveyor at tender stage and the quantity surveyors themselves appear to acknowledge that they first became appointed at this stage.

Table 6.23 Quantity surveyor appointment at tender stage (Questions C2.3, A2.3, QS2.1, E2.3)

QS appointment at tender stage	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Seldom / never	13	5	14	3	35
Occasionally	17	6	3	5	31
Always	19	18	15	14	66
Total	49	29	32	22	132

It appears that the results of Table 6.21 contradict the established literature, but the results of Tables 6.22 and 6.23 agree with the literature. For example, Bowen (1993) found that, whereas the majority of quantity surveyors consider it necessary to be appointed at the inception stage, a considerable proportion of them were not appointed at the inception of the project but later in the project's development.

6.3.2.11 Perception of the importance of estimated cost

In this sub-section, the perception of the importance of the estimated cost is examined. It has been established from the data shown in Tables 6.21 to 6.23 that the majority of quantity surveying firms is appointed late in the life of the project, so the quantity surveyor involvement in the provision of the cost plan is delayed. The client's perception of the importance of the estimate would have a significant bearing on their commitment of resources to the project. Early capital commitment may be influenced by other factors, but the importance that the client attached to the investment plan – and therefore the appointment of the quantity surveyor – was essential in making sure that the decision to build was founded upon an adequate knowledge-base (Bowen and Edwards, 1985).

The perception of importance of estimated cost is examined in this sub-section, namely:

At sketch design stage respondents showed that they rarely considered the building estimate as an important tool to guide project design.

- the importance of receiving/producing the estimate at detail design stage
- the importance of receiving/producing the estimate at tender stage.

These two variables were selected because of the influence of these two stages of construction on the estimated final project cost. The estimate produced at detail design stage guides the overall project development, while the estimate produced at tender stage is a useful tool in guiding the selection of who will be awarded the contract.

The examination was intended to ascertain opinions from recipients of cost planning services, in order to find the importance they attached to building estimates. Opinions from the client, architectural and engineering firms were therefore sought in Questions C2.4, A2.4 and E2.4. The respondent opinion was useful to this study in interpreting the quality of quantity surveying services offered to the client. Further, the questions were intended to clarify the issue of the stages by which construction estimates are perceived to be important by the recipient.

6.3.2.12 Importance of the estimate at detail design stage

Having the prepared estimate produced in good time is important for effective project management. The literature (e.g. Edwards, 2001) suggested that building team members have different risk perceptions. The researcher, aiming at a better understanding of the nature and extent of building risk, sought opinions from respondents on the importance attached to cost plans. The respondents were asked (see Questions C2.4, A2.4 and E2.4) how important they thought the cost estimates used by the quantity surveyor in cost plans were.

Table 6.24 Importance of estimate at detail design stage (Questions C2.4, A2.4, E2.4)

Importance of estimate at detail design stage	**Number of respondent firms and organisations**			Total
	Client	**Architectural**	**Engineering**	
Not important	12	1	2	15
Important	24	15	12	51
Vitally important	20	26	18	64
Total	56	42	32	130

The results in Table 6.24 show the rated importance of the estimate at detail design stage. A budget predicted before the detail design stage would be within the recommendations of R.I.B.A. Plan of Work (1980) and be considered good cost and risk management practice, and nearly half the respondents (49%) indicated that the cost estimate was 'vitally important' at detail design stage and a further 37% considered that the estimate was 'important' at this stage (Table 6.24).

The implication here was that the estimate was not really considered to be a cost management instrument before the start of detail design. These practices thus appear to run counter to the recommendations of the Code of Practice (1985) and the R.I.B.A. Plan of Work (1980).

6.3.2.13 Importance of estimate at tender stage

The perception of the importance of the estimate at tender stage was examined, in order to establish the nature and extent of perception of cost estimates at this stage. At tender stage the final decision to build is taken, before the actual construction commences. Questions C2.4, A2.4 and E2.4 asked the respondents for their opinions on receiving the estimate at tender stage. The information obtained was important to effective cost planning due to its influence on received tenders. The results are reported in Table 6.25.

Table 6.25 Importance of estimate at tender stage (Questions C2.4, A2.4 and E2.4)

Importance of estimate at tender stage	Number of respondent firms and organisations			Total
	Client	Architectural	Engineering	
Not important	5	1	5	11
Important	16	9	11	36
Vitally important	35	32	14	81
Total	56	42	30	128

The figures in Table 6.25 show that the great majority of the respondents (93%) said that the estimate was either important or vitally important at tender stage. The result was not surprising as it was in keeping with the conclusions of Morrison (1983) on cost checking of estimated costs against cost plans at tender stage.

Cost planning forms the basis for contract price comparison because the traditional arrangement requires the project to be thoroughly evaluated prior to the works being offered to tender (Senior, 1990). Thus the estimated cost plan needs to be fully documented prior to tenders being invited, so that it can guide building procurement.

This section has dealt with the nature and extent of current cost planning practices in Kenya as well as the users' perception of the importance of cost plans. The next section will examine the current cost planning services offered by the quantity surveyor.

6.3.2.14 Current quantity surveying practices

In this section, four aspects of cost planning are examined, to establish the nature and extent of current cost planning and control practices in Kenya. To elicit respondents' experiences from previous projects, this examination was conducted in four parts, namely:

- establishment of cost control
- cost limits setting
- elemental cost planning
- comparative cost planning.

Choosing these four parts under which to discuss current practices was based on the view that planning is about setting achievable goals and controlling processes to reach these objectives. In building projects, the quantity surveyor is concerned with achieving the cost objective and must therefore devise the means to achieve that goal. Setting cost processes aimed at achieving cost targets in cost control practice, and cost expenditure limits, are means of achieving those objectives.

The literature (e.g. Uher, 1996) has suggested other means of achieving cost objectives through established and recommended work plans (e.g. Code of Practice, 1985). Therefore the researcher decided to examine data from elemental and comparative cost planning methods, to find out whether they are offered by the quantity surveyor in cost planning.

The questions included in this Sub-section (C2.5, A2.5, QS2.6 and E2.5) were aimed at obtaining information used by the quantity surveyor and trends in cost planning. The respondents were therefore asked to identify current practices in the cost planning of their construction budgets.

The clients were asked the following questions:

1. Do you set up a budget plan to control cost on projects?
2. As part of the cost plan do you establish a cost limit with the design team?
3. Are you aware of the concept of cost planning?
4. Does the design team assist in the formulation of the brief?
5. Do all consultants receive a copy of the brief?
6. Does your representative feel an integral part of the design team?

The engineering, architectural and quantity surveying firms were asked:

1. Do you require from the quantity surveyor a budget plan to control cost on projects?
2. As part of the cost plan do you establish a cost limit with the client?
3. Which of the following cost budget planning systems do you require:

   Elemental cost planning system (designing to a cost)

   Comparative cost planning system (costing a design)

   Other (please elaborate)?

The results are recorded in four tables: 6.26 to 6.29.

6.3.2.15 Establishment of cost planning and control

In this first part of investigating current cost planning and control practices, the establishment of cost controls is examined, to ascertain the extent of cost control in current practice. Respondents' opinions on the services received from the quantity surveyor regarding cost planning and control were sought from the client, architectural, and engineering firms. Table 6.26 records the information obtained on their perceptions of cost control.

Table 6.26 Current practice of cost planning and control (Questions C2.5, A2.5, QS2.6, and E2.5)

Do you set up a cost control plan?	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
No	6	11	14	8	39
Yes	56	34	25	27	142
Total	62	45	39	35	181

If cost planning and control was not carried out in accordance with cost controls procedures it could be expected that over-designing and cost overrun might result. Over 80% of the client, architectural and engineering respondents required cost controls or budget plans from the quantity surveyor to control the cost of projects. At the same time only 64% of quantity surveying firms reported that they set up cost planning and controls for their projects.

The result shows that, although cost planning and control is required in risk management, not all quantity surveyors are effectively motivated to provide cost planning and controls.

6.3.2.16 Setting cost limits in cost planning

In the second part of the investigation, setting limits in cost planning is examined to establish the planning process. It is evident from Table 6.26 that cost controls were generally required for projects. It is suggested in the literature (Correia et al., 2000) that the client controls the cost of the project through capital rationing. To determine whether cost limits are used, the respondents were requested to provide information on the practice of setting cost limits in the cost planning process. The information obtained is recorded in Table 6.27.

Table 6.27 Practice of setting cost limits (Questions C2.5, A2.5, QS2.6, and E2.5)

Do you establish a cost limit?	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
No	19	3	8	5	35
Yes	41	41	31	30	143
Total	60	44	39	35	178

Almost all (86%) of responding architectural, engineering and quantity surveying firms indicated that they set cost limits with the client, though only two-thirds of the clients said that they established a cost limit with the design team (see Appendix 2). In the literature (e.g. Songer et al., 1997), setting cost limits is considered to be an inappropriate means of cost planning, since changes are likely to occur as the project develops. However, setting cost limits has the advantage that it hinders large and expensive design variations (Lowe and Whitworth, 1996).

From these results (Table 6.27), it appears that it was considered necessary to set cost limits with the client, to control building cost. If the setting of the cost plans is done to guide building cost then, generally, it was also thought necessary to establish the nature of cost planning practised by the quantity surveyor.

6.3.2.17 Elemental cost planning

Elemental cost planning (designing to a cost) is now examined, to establish the nature and extent of the problems faced by the quantity surveyor in cost planning and control. The architectural, client and engineering firms were asked to indicate which planning systems they required regarding the types of cost planning practised by the quantity surveying firms. Two types of cost planning and control methods were proposed to the respondents, in Questions A2.5, QS2.6, and E2.5, to identify the current practices of budget planning and control at inception.

Elemental cost planning was suggested as the first method which respondents might use in their cost planning (Uher, 1996). The question was aimed at establishing the usefulness attached to the elemental cost planning method. Table 6.28 records the responses received.

Table 6.28 Practice of elemental cost planning (Questions A2.5, QS2.6, and E2.5)

Do you require elemental cost planning?	**Number of respondent firms and organisations**			Total
	Architectural	**QS**	**Engineering**	
No	9	8	8	25
Yes	25	31	20	76
Total	34	39	28	101

About three quarters of all the respondents said that they used the elemental method for cost planning for their projects.

It is generally observed in the literature (e.g. Uher, 1996) that elemental cost planning needs continued upgrading of records, and unless this is carried out continuously on gathered cost data, this method might produce a skewed budget of the cost plan.

6.3.2.18 Comparative cost planning

The alternative to elemental cost planning is the comparative method (costing-a-design).

Table 6.29 The practice of comparative cost planning (Questions A2.5, QS2.6, E2.5)

Do you require comparative cost planning?	Number of respondent firms and organisations			Total
	Architectural	QS	Engineering	
No	10	6	2	18
Yes	27	23	25	75
Total	37	29	27	93

Questions A2.5, QS2.6 and E2.5 asks for responses relating to this method of cost planning. The information obtained was regarded as an indicator of cost plans produced by the quantity surveyor. Table 6.29 gives the results obtained from the respondents.

The use of the comparative cost planning method implies the production of several design alternatives for discussion with the design team. Table 6.29 shows that a very large majority of all the firms, especially engineering, did use the comparative cost planning method.

The totals for comparative cost planning were similar to those for elemental cost planning, although the breakdown across users was slightly different. This implied that both methods were equally used by the respondents, although a few did not consider either of the methods important for project cost planning. It might be they have other methods they use in cost planning building projects. This was contrary to the expectations of the researcher who had thought that elemental cost planning would be more popular with all respondents.

The nature and extent of quantification risk in cost planning has been presented. It is evident from the literature (e.g. Akintoye and Fitzgerald, 2000) that one of the main causes of inaccurate cost estimates might lie the area of quantifying information and data. Therefore the next section will examine accuracy risk in the planning and control process.

6.3.3 Accuracy risk in the practice of cost planning and control

In this section an overview of accuracy risk in the practice of cost planning and control is presented, to determine the nature and extent of accuracy risk in the cost planning and control process. Respondents were requested to indicate their opinions on the accuracy of quantity surveyor estimates (see Questions QS4.2; C 2.11, C 2.12; A 2.11, A2.12; QS 2.12, E2.11 and E2.12).

The examination of the data was conducted in five sub-sections, namely:

- data analysis of accuracy risk in cost planning and control practices
- the use of bills of quantities in the estimating process
- the accuracy expected from estimates
- the accuracy of received estimates
- factors influencing the accuracy of cost planning estimates.

The rationale for presenting the examination of accuracy in cost planning in five sub-sections was that the accuracy of the estimated cost depends on the identification of all potential risks and their consequences. The first step in determining the accuracy risk in cost planning is to check in the provided information for the existence of uncertainty by reviewing the project description and the potential risks (see questions QS2.11 and QS4.2). Identification of all potential risks is the first step in risk assessment, followed by the establishment of the probable size of their impact (Kim and Bajaj, 2000).

The bills of quantities method of estimating helps establish the size of impacts by evaluating and assessing the identified risks for their cost impact. Thus it was necessary to do data analysis to establish the nature of risks in building projects.

When evaluating risk it is important to consider the accuracy levels that were expected from the estimates before embarking on a detailed analysis of the risk. So, on the basis of the importance attached to the accuracy of the estimate, the researcher decided to examine the respondents' expectations of the estimates and types of accuracy that were expected and received in the provision of estimates.

Lastly, the researcher decided to examine the factors that influence the accuracy of the estimated cost plans offered by the quantity surveyor (see Questions QS2.10, QS2.13 and QS4.5).

Opinions gathered relating to accuracy of estimates was expected to give the researcher a basis for interpreting the effectiveness of the service offered by the quantity surveyor in cost planning. For this reason, client, architectural and engineering firms were asked for their opinions on accuracies in estimates, in order to increase the understanding of probable causes of inaccuracy and other deficiencies in the cost plans.

In the literature (e.g. Brandon and Newton, 1986) it is generally considered that inaccurate estimates establish a deficiency in project information (see Section 6.3.2) and quantifying information after this generally affects the accuracy of the cost plan. In the risk management process there is a need to determine significant risk sources for cost planning purposes, which could be used to prioritise risk responses (Ward, 1999).

Client, architectural, quantity surveying and engineering respondent groups were asked their opinions on the accuracy of cost plans and budget prediction, and more specifically on budget accuracy perceptions and potentials of estimating methods. Certain questions, for example QS4.2, C 2.11 and C 2.12, A 2.11 and A2.12, QS 2.12 and E2.11 and E2.12, requested opinions on cost plan accuracy at different project development stages. The opinions from the respondents are summarised and presented in the data analysis of accuracy risk reported in Tables 6.30 to 6.36.

6.3.3.1 Data analysis of accuracy risk in cost planning and control practice

In this first sub-section of Section 6.3.3 the overview of data analysis of survey questions relating to accuracy of cost plans is presented. The overview is aimed as a summary of the examination of the data collected to establishing the nature and extent of accuracy risk in cost planning.

The data analysis of accuracy risk in the planning process attempts to increase our understanding of the nature and extent of accuracy risk in cost planning practices. Therefore significant variables were selected from the literature for examination in the study. Twenty-three accuracy-related variables were offered to the respondents in the questionnaire and six cost-significant variables were selected for examination in this study. The researcher considered those six variables as important indicators of the type of accuracy risk in the current practices offered by the quantity surveyor. The information gathered is summarised in Tables 6.30 to 6.36.

It was generally accepted in the literature (e.g. Pender, 2001; Chapman, 2001) that a reasonable amount of information is needed to establish an accurate cost plan. However, information generated from the client and from the building participants tended to be incomplete and insufficient at early project stages (Senior, 1990). Previous studies (e.g. Pender, 2001; Tah and Carr, 2000; Fitzgerald and Akintoye, 1995) found inaccuracy in the cost planning process was due to lack of practical knowledge of the construction process from those responsible for the estimating functions. Therefore the researcher found it necessary to focus on accuracy risk arising from the service offered by the quantity surveyor in the cost planning of building projects.

6.3.3.2 Use of bills of quantities in building estimates

In this second sub-section of Section 6.3.3, use of the bills of quantities method to provide building estimates in the cost planning process is examined. This done in two parts, namely:

- the potential of bills of quantities to provide building cost estimates.
- the quantity surveyor's view of the accuracy of various estimating methods.

The rationale for selecting the first of these two variables was that there is insufficient information at project inception and that project information increases as the project develops, thus encouraging the use of bills of quantities. The literature (e.g. Akintoye and Fitzgerald, 2000) has recognised that the major causes of inaccurate cost estimates are poor document analysis by the estimating team, and poor tender documentation. These two causes of inaccuracies are dependent on effective use of the bills of quantities and the accuracy expected from the quantity surveyor. For this reason the researcher decided to examine opinions from the respondents on the potential of the bills of quantities method and the level of accuracy obtained from the bills of quantities.

6.3.3.3 Potential of the bills of quantities cost estimating method

This part of the second sub-section of Section 6.3.3 examines traditional cost estimating methods in the provision of building estimates. The results of Questions C1.8, A1.7, QS1.7 and E1.7, shown earlier in Table 6.20, made it clear that respondents preferred to use bills of quantities method in the contract documents in the procurement process. Uher (1996) argues that the bills of quantities method, places limitations on the cost planning and control process. Thus, in order to ascertain the nature and extent of the utilisation of the bills of quantities, its potential in estimating building cost plans had to be examined to find its effect on the services offered by the quantity surveyor.

Questions C4.2, A4.2, QS4.2, and E4.2 asked respondents to give their opinions on the potential of the bills of quantities method to assess allowances for risk in cost planning and control. The results obtained are summarised in Table 6.30.

Table 6.30 Potential of bills of quantities method (Questions C4.2, A4.2, QS4.2, E4.2)

Potential of bills in assessing risk allowances	**Number of respondent firms and organisations**				Total
	Client	**Architectural**	**QS**	**Engineering**	
Poor	3	2	0	1	6
Acceptable	18	9	0	9	36
Good	42	31	39	24	136
Total	63	42	39	34	178

As can be seen from Table 6.30, over three-quarters of the respondents (76%) reported that the bills of quantities method had good potential to incorporate risk allowances. A quarter (29%) of the client respondents accept the method of bills of quantities as a cost planning procedure thereby showing a reluctance to use the bills of quantities method of estimating. All the quantity surveying firms stated that the bills of quantities method has good potential for assessing risk allowances.

To the researcher the results shown in Table 6.30 meant that the bills of quantities method of estimating was good for assessing risk allowances in cost plans. It appears that using bills of quantities was regarded as a good estimating method by all quantity surveying firms.

6.3.3.4 Quantity surveyor's perception of estimating methods

This part of the second sub-section of Section 6.3.3 examines quantity surveyors' perceptions of the accuracy achievable by using different estimating methods. Question QS2.1 asked quantity surveying firms to indicate their perceptions of the accuracy of five different methods (functional unit, superficial, approximate quantities, elemental and bills of quantities) in cost planning. This examination was done in an attempt to establish the extent to which Kenyan quantity surveying firms are involved in the provision of risk management in the estimating process. The data obtained was a basis for interpreting the effectiveness of the service offered by the quantity surveyor. The results are recorded in Table 6.31.

The bills of quantities method was selected as an exemplar because, in the opinion of the researcher, it has the best potential for assessing risk.

Table 6.31 Perceptions of accuracy of bills of quantities method (Question QS2.11)

Expected inaccuracy using bills of quantities method for estimating final cost	Number of QS respondent firms
Above 30%	6
Less than 30%	0
Less than 25%	3
Less than 20%	0
Less than 15%	1
Less than 10%	8
Less than 5%	22
Total	40

Table 6.31 shows that 55% of quantity surveyors considered that the bills of quantities method had the potential to assess risk allowances to within 5% of the final building cost. The results depicted in Table 6.31 showed that a significant number (20%) of quantity surveying respondents had a different perception of the bills of quantities method; some quantity surveying firms indicated that the method can only be accurate to within 10% of the estimate of the final building cost a view supported by 20% of the respondents.

These results imply that accuracy of estimates was generally thought to be achievable to within 5% of the final building cost, when using the bills of quantities method. In the opinion of the researcher, gained over a decade or more of experience, the accuracy of the estimated cost plan should be within 10% of the estimated final cost- a view supported by 20% of the respondents.

6.3.3.5 Accuracy expected from building cost estimates

This third sub-section of Section 6.3.3 presents an analysis of the data obtained on the accuracy expected from quantity surveyor estimates, in an attempt to establish the nature and extent of the accuracy expected from them in cost planning. In the research of Bowen (1993), the mean expected accuracy level was found to have been 5 to 17 per cent of the estimated cost at the various stages of building design. To check whether the expected accuracy in the current Kenyan practices was at the same level as that found by Bowen, the researcher decided to examine the accuracy expected from the cost estimator and receivers' points of view. The researcher selected two stages of the project development to examine on the issue of expected accuracy in cost plans, namely:

- expected accuracy levels at project inception

- expected accuracy levels at different stages of project development particularly the pricing of the Bills of Quantities for estimating cost plans in comparison to tenders.

It appears from the results shown in Tables 6.30 and 6.31 that Kenyan quantity surveying firms preferred to use the bills of quantities method, but in the literature (e.g. Brandon and Newton, 1986) quantity surveyors were shown to prefer to use approximate quantities in various forms for their estimates. Therefore the researcher considered it important to examine the expected accuracy at both project inception and at different stages of project development.

The rationale for selecting these two stages was that the inception stage and the tender-stages are equally important in the estimating process of the client and in obtaining funding for the project.

6.3.3.6 Expected accuracy at project inception

In this first part of the third sub-section of Section 6.3.3, the researcher examines the variables relating to the expected accuracy of estimates at inception stage relative to the accepted tender. The expected accuracy of this estimate at project inception was considered important as this is the stage at which a cost plan is most needed to guide project development.

Table 6.32a Expected accuracy at inception (Questions C 2.11, A2.11, QS2.12, E2.11)

Expected inaccuracy at inception stage relative to accepted tender	**Respondent firms and organisations**				Total without QS
	Client	**Architectural**	**QS**	**Engineering**	
Above 30%	11	4	5	7	22
Less than 30%	2	2	5	2	6
Less than 25%	14	11	4	4	29
Less than 20%	22	10	12	11	43
Less than 15%	5	8	8	2	15
Less than 10%	2	1	4	0	3
Less than 5%	2	2	1	1	5
Total	58	38	39	27	123

The results obtained questions C2.11, A2.11, E2.11 and QS2.12 are recorded in Table 6.32a. About a third (35%) of the receiving respondents reported that they expected the accuracy level at inception of project to be within 20% of the estimated final building cost relative to the accepted tender. A similar proportion (31%) of the quantity surveyors said that they expected this accuracy in their estimates.

Table 6.23b shows running totals, which give the figures within which the various estimations lie.

Table 6.32b Totals for expected accuracy at inception (Questions C 2.11, A2.11, E2.11)

Expected error	Total without QS
Above 30%	22
Less than 30%	6
Less than 25%	29
Less than 20%	43
Less than 15%	15
Less than 10%	3
Less than 5%	5
Total	123

This table shows that over 80% (100 out of 123) of the receiving respondents do not expect better than 20% accuracy. Approximately a quarter of the client (19%) and engineering (26%) firms indicated that, at project inception stage, the accuracy could be expected to be only within 30% of the accepted tender sum. A similar percentage (29%) of architectural firms indicated that the estimate would be within 25% of the final estimated cost relative to accepted tender sum.

The implication of the figures in Table 6.32 was that at early project stages, the building budget was expected by respondents to be within 30% of the final building cost.

6.3.3.7 Expected accuracy at tender stage

In this second part, the nature and extent of the accuracy expected from the quantity surveyor at tender stage is examined. In the literature (e.g. Senior, 1990) it is clear that incomplete design and insufficient project information affect predicted budget. It was found that in the current practice in Kenya, quantity surveyor involvement at project inception was minimal (see Section 6.3.1), and therefore accuracy in estimating was to be found not at inception stage but at tender stage. Respondents' opinions on expected accuracy of estimates offered by the quantity surveyor were examined at post-tender stage and the results are tabulated in Table 6.33.

Table 6.33 Accuracy expected at post-tender stage (Questions C 2.11, A2.11, QS2.12, E2.11)

Expected inaccuracy at post-tender stage relative to accepted tender	**Respondent firms and organisations**				Total without QS
	Client	**Architectural**	**QS**	**Engineering**	
Above 30%	10	3	4	0	13
Less than 30%	1	0	0	0	1
Less than 25%	12	3	0	5	20
Less than 20%	8	2	0	3	13
Less than 15%	4	2	1	0	6
Less than 10%	4	8	6	6	18
Less than 5%	17	21	20	16	54
Total	56	39	31	30	125

Table 6.32 shows that fewer than half (43%) of the receiving respondents reported that at post-tender stage they expected the accuracy levels of estimates to be within 5% of the cost estimate relative to the accepted tender. On the other hand, nearly two-thirds of the quantity surveyors said that they expected their estimates to be within this range. The figures also show that 14% of receiving respondents (and 15% of all respondents) expected the estimate to be accurate to within 10% of the accepted tender. A significant number (18%) of client organisations expected the accuracy of the estimate to be within only 30% of the accepted tender.

The researcher's interpretation of the results given in Table 6.33 is that they showed that the cost plan receivers had low expectations of the predicted estimate accuracy even at the post-tender stage. It appears that, even when there was adequate project information, the expected accuracy was not achieved. The literature (Mok et al., 1997) indicates that, by tender stage, an estimated building cost plan should be within 5% to 10% of the final estimated cost.

It is clear that expected accuracy levels will increase with the availability of project information since at post-tender stage all necessary project information is established and defined. Given the results shown in Table 6.33, the disparity between the opinions of the quantity surveyors and those of the user respondents shows the importance of the recipients' opinions as potential information feedback to the surveyors.

6.3.3.8 Accuracy of the received estimates

In this fourth sub-section of Section 6.3.3, accuracy at project inception is examined in order to understand the nature and extent of the accuracy of estimates given by the quantity surveyor at project inception stage. Questions C2.12, A2.12, and E2.12 attempt to get feedback responses from the users of quantity surveying services. This was done for two project stages, namely:

- accuracy of estimates received at project inception stage
- accuracy of estimates received at tender stage.

These two stages were selected for examining the accuracy of received estimates because of their importance in guiding project development. At project inception the client should be made aware of the likely expenditure that could arise from the building project. At tender, the quantity surveyor is expected to commit the client to a defined amount of expenditure for the project. The accuracy the estimates received from the quantity surveyor affects the cash flow projections of the client and it is important that an assurance should be set out to give the client value for his or her investment.

6.3.3.9 Accuracy of estimates received at inception stage

Questions C2.12, A2.12 and E2.12 asked user respondents to give their opinions on the accuracies actually received because it is shown in the literature (e.g. Al-Momani, 1996) that these were likely to be at variance with expected accuracy levels (relative to the accepted tenders). A mechanism was needed to find the perception of the receivers of the cost planning and control services by examining the accuracy received at project inception. This was done in an attempt to determine the factors that influence the accuracy levels of estimates received from the quantity surveyor at the various stages of a project. A summary of the responses to the questions is shown in Table 6.34.

Table 6.34a Received budget accuracy at inception (Questions C2.12, A2.12 and E2.12)

Inaccuracy of estimate received at inception relative to accepted tender	**Respondent firms and organisations**			Total
	Client	**Architectural**	**Engineering**	
Above 30%	10	10	5	25
Less than 30%	2	2	2	6
Less than 25%	10	6	7	23
Less than 20%	15	9	0	24
Less than 15%	5	7	6	18
Less than 10%	5	0	1	6
Less than 5%	6	1	1	8
Total	53	35	22	110

About one fifth of the respondents reported that, at inception, accuracy levels of estimates received from the quantity surveyor were only within 30% of the actual value of the accepted tender. About a quarter of client organisations indicated that the estimates they receive were within a 20% accuracy level relative to the accepted tender, and a third of the engineering firms indicated that they received estimates which were within 25% accuracy levels relative to the accepted tender.

6.3.3.10 Accuracy of estimates received at tender stage

In the second part of the examination of accuracy risk, the accuracy of estimate received at tender stage is examined. It is clear from the results shown in Table 6.34 above that, at project inception, the accuracy of cost plans produced by the quantity surveyor was below expectations of the client, architectural and engineering firms. The researcher wanted to find out whether any improvement in the accuracy of the received estimate (relative to the accepted tender) occurs by tender stage. The results obtained were regarded as an indicator of the quality of cost planning practices. Questions C2.12, A2.12, and E2.12 asked the estimated cost users to give accuracy levels for the estimates they received at tender stage. The information received is recorded in Table 6.35.

Table 6.35 Accuracy of received budget at tender stage (Questions C2.12, A2.12, E2.12)

Inaccuracy of estimate received at post-tender stage relative to accepted tender	**Respondent firms and organisations**			Total
	Client	**Architectural**	**Engineering**	
Above 30%	14	3	2	19
Less than 30%	0	1	0	1
Less than 25%	6	2	2	10
Less than 20%	15	6	11	32
Less than 15%	3	7	0	10
Less than 10%	14	10	8	32
Less than 5%	5	15	6	26
Total	57	44	29	130

A quarter of the respondents reported that accuracy at tender was within 20% of the final cost estimate. Client, architectural and engineering firms indicated that the accuracy level was within 10% relative to the accepted tender. The data given in Table 6.35 show that a third of architectural firms (34%) reported that the accuracy level at post-tender stage was within 5% of the final value, but at the same time 38% of engineering firms reported that the accuracy level was only within 20% of the accepted tender value. A surprising result was obtained from the client organisations as 25% of the respondents gave a quite different answer to the question, indicating that the inaccuracy of the received estimated plan was above 30% relative to the actual accepted tender.

The implication of these results is that the estimates given by quantity surveyors at tender stage were not convincing to the client, architectural and engineering firms, even after estimators received the increased project information available at tender stage. An implied interpretation is that the accuracy of the received cost plans was not meeting the expectations of the recipients. To the researcher it appears that there is room for improvement in the accuracy of estimates provided by the quantity surveyor.

6.3.3.11 Factors influencing the accuracy of cost planning estimates

In this final sub-section of Section 6.3.3, accuracy risk in the estimating process is examined. It aimed at providing an indicator of the estimating process used by the quantity surveyor in cost planning of building projects.

In the literature, the experience of the consultant, the available information and the estimating method are given as the main factors affecting the accuracy of building estimates (Bowen, 1993). Furthermore, Akintoye and Fitzgerald (2000) and Kaming et al. (1997) associate lack of accurate budget prediction with lack of accurate, meaningful and comprehensive information from the bills of quantities and drawings. Others, for example, Senior (1990), have established that the nature and extent of accurate estimates in the provision of cost planning varies from project to project.

Since the quality of an accurate cost plan might be influenced by a number of factors, six such factors were listed in Question 2.13, and respondents were asked to indicate those they thought significant. The factors suggested were: estimating expertise, having a good cost data base, the amount of design information available, the suitability of the estimating methods, the actual method used, and 'chance'. The factor most strongly indicated by the respondents as influencing the accuracy of the estimate was 'amount of design information available', followed quite closely by 'good cost data base' (see Appendix 3).

The results given in Table 6.36 show the quantity surveyor' opinion on the influence of 'amount of information available' on the quality of cost planning produced by the quantity surveyor.

Table 6.36 Accuracy and available information (Question QS 2.13)

Accuracy of estimate depends on amount of information available	Number of respondents from QS firms
Occasionally	0
Always	40
Total	40

Not surprisingly, all the quantity surveying (QS) respondents reported that the accuracy of their estimates always depended on the amount of information available to them.

6.3.4 Summary of practice in cost planning and control in Kenya

In this section a summary of the practice of cost planning and control in Kenya is presented. The presentation is conducted in three parts, namely

- information and data risk
- quantifying risk
- accuracy risk.

6.3.4.1 Summary of information and data risk in cost planning and control

Quantity surveying firms seldom or never produce the first cost plan at feasibility stage. It appears that the majority of professional building cost consultants wait for the production of the detail design before producing the first cost plan.

Architectural and engineering firms seldom or never receive information from the quantity surveyor before establishing the budget for the client at inception of the project. Although quantity surveying firms reported that they always establish the first project cost plan for the client at inception stage, this did not appear to be the case in practice.

The majority of clients received the first detailed cost plan from the quantity surveyor at tender stage.

The majority of clients were aware of the concepts of cost planning and control.

It appears that the majority of architectural, quantity surveying and engineering firms seldom or never check the estimate against the cost plan at feasibility stage. Further, the majority of respondents reported that they checked the estimated cost against the cost plan at detail design stage.

The issues revealed in the section showed that there is insufficient project cost information from the quantity surveyor to first establish a budget for the client at the early project development stages. It appears to the researcher that the quantity surveyors were unable to first establish the budget at the early inception stage of the construction project.

6.3.4.2 Summary of quantifying risk in cost planning and control

It appears that a quantity surveyor was appointed in most Kenyan building projects. Worthy of note was that the majority of client (54%) and engineering (51%) firms always had a quantity surveyor appointed for their project but the majority of architectural firms did not always appoint a quantity surveyor for their project.

Most respondents have been involved in more than one form of documentation in the contract procurement process but the bills of quantities method was the preferred documentation method in this process. A significant number of architectural firms (27%) and client organisations (35%) indicated that they used the selected tender method for a third of the contracts in their projects.

Client organisations and engineering firms (45%) always appoint a quantity surveyor at project inception and a significant number (36%) of architectural firms occasionally appoint a quantity surveyor at this stage. More than a third of architectural and engineering respondents always appointed a quantity surveyor at tender stage. The majority (53%) of the quantity surveying firms reported that they are appointed at detail design stage.

Nearly half of client, architectural and engineering firms (49%) indicated that cost estimate was 'vitally important' at detail design stage and the majority of respondents (86%) reported that the estimate was vitally important at tender stage.

The majority (64%) of quantity surveying firms reported that they are requested to set up cost controls for projects while the majority (81%) of respondents indicated that they set cost limits with the client.

In conclusion, therefore, the findings suggest that the use of cost controls and cost limits are always established, but the issue of how the respondents control the quantification risk in cost planning and control needs further clarification.

6.3.4.3 Summary of accuracy risk in cost planning and control

The majority of all respondents (76%) reported that the bills of quantities method of estimating cost plans had good potential for incorporating risk allowances. It appeared that for 100% of the quantity surveying firms this method was regarded as having good potential for incorporating risk allowances.

For more than half of the quantity surveying (55%) respondents, the bills of quantities method had the potential to assess risk allowances to within 5% of the final building cost. A quarter (29%) of the client respondents reported that the bills of quantities method was acceptable but not the best method of estimating.

The accuracy of the building budget could be expected to be within 20 to 30% of the final building cost, relative to the accepted tender at project inception stage.

About a fifth (22%) of client, architectural and engineering firms reported that, at inception, the inaccuracy levels of estimates received from the quantity surveyor were above 30% relative to the accepted tender.

It appears that nearly a third of architectural firms (34%) reported that the accuracy level at tender was indicated to be within 5%, but at the same time 38% of engineering firms reported that the accuracy level at tender would only be within 20% relative to the accepted tender.

All the quantity surveying respondents (100%) reported that accuracy of estimate always depended on the amount of information available.

The received accuracy levels in estimates relative to the final cost were not convincing to the recipients of cost plans.

The clarification on information risk, quantifying risk and accuracy risk in cost planning and control is discussed further in Chapter 8.

A summary of the provision of the practice of cost planning and control has been presented in Section 6.3. The practice of risk management in the planning process is now examined in Section 6.4.

6.4 The practice of risk management performed by quantity surveyors in Kenya

6.4.1 The practice of risk management

This section examines the practice of risk management in cost planning to establish the nature and extent of the risk management practice in building projects. The data examination in Section 6.3 was aimed at obtaining information on the opinions of clients, architectural and engineering firms on the provision of estimated cost plans in building projects.

The data analysis on the practice of risk management in the planning and control was conducted focusing on three themes, namely:

- cost impact risk
- frequency of occurrence risk
- response risk.

The rationale for selecting the four sections in risk management was that risk assessment is about risk identification and quantified of risk impacts. However, the critical point in the assessment of potential risks is planning for unknown risks and the budgets to cover these extra expenses. In risk management it is important to evaluate the size of the impact and the frequency of those impacts (Edwards, 1995). Therefore the researcher decided to examine cost impacts risk and frequency of occurrence risks which might arise out of the decision taken by the quantity surveyor in cost planning of building projects.

Developing a risk plan covering all likely risks is difficult. Risks affecting a building project might be unknown during cost planning. Risk planning requires early identification of the risk sources so that the outcomes would be determined and the type of action needed to be taken to address the risks (Kim and Bajaj, 2000) that are to be incorporated into cost plans. For this reason the researcher decided to consider and examine the likely response risk that would be generated by judgement of the project information.

6.4.1.1 Risk management performed by the quantity surveyor

In this section of Chapter 6, the practice of risk management in cost planning and the control of building costs is examined to establish the nature and extent of risk management practice in building projects in Kenya. The examination of the data was conducted in three sections, namely cost impact risk (Section 6.4.1), frequency of risk occurrence (Section 6.4.2) and response risk (Section 6.4.3). Finally, section 6.4.4 provides a summary of the whole of Section 6.4.

Risk management is viewed by Raftery (1994a) as the synthesis of three distinct stages: identification, analysis and response, and this study attempts to follow this pattern. Edwards (1995) agrees, saying that this is the order in which risk assessment is generally done. It is also generally considered in the literature (e.g. Ward, 1999; Kaming et al., 1997) that the type of risk responses made depend on the size of the risk impact. The researcher decided to follow the cost assessment procedures laid down in the literature (e.g. Ward, 1999) in examining the three variables, to establish their effect on cost planning.

In understanding the nature and extent of risk management in cost planning, it was necessary to establish the practice of risk management in the cost plans and control offered by the quantity surveyor. This was done by examining the practices indicated and received on risk management in which planning is practised by the quantity surveyor. The cost planning practices received were expected by the researcher to cover risk management practices and their influence on the way risk assessment is used in establishing the building cost plans. In the third section of the questionnaire survey, the research participants were requested to indicate their risk management practices in projects regarding project information and risk management procedures carried out in their current projects (see Questions C3.1 to C3.3, A3.1to A3.3, QS3.1 to QS3.3 and E 3.1 to 3.3). The information and data collected was then summarised in the four sections mentioned in the previous paragraph.

6.4.1.2 Cost impact risk in risk management

The list of the risk factors given in the questionnaires comprised:

(a) Questions 3.1 – 3.3 Risk factors and sources:

(b) Contract: Size of project/Complexity of project/Location of project/Conditions of contract/Type of procurement system

(c) Client/Professional team: Quality of design information/Design completeness/Type of client/Design variations/ Brief uncertainty

(d) Estimating: (Pre-tender) Experience of estimator/Expertise of estimator/Quality of estimating data/Type of estimate/Experience of architect (Post-tender)

(e) Timeous cost reports/Timeous completion of final account/Accurate progress payment valuations

(f) Project risks: Natural events (e.g. earthquakes)/Contract period overrun

(g) External factors: Inflation and market conditions/Tender conditions/Political uncertainties/Interest rate changes.

In this section (Section 6.4.1), cost impact risk in risk management is examined to establish the nature and extent of cost impact risk in cost planning. The researcher believed that the information obtained would be an indicator of the type of risk management practices offered by the quantity surveyor. The examination of the data was conducted in the above-mentioned four parts:

- data analysis of cost impact risk
- project risk as a cost impact
- design information and data as a cost impact
- external risks as cost impacts.

The rationale for conducting the examination in these four parts was that cost impact assessment of a risk has to start with an analysis of the risk information made available to the quantity surveyor by the client and others. In addition, these four variables were indicated by respondents in the preliminary analysis (see Appendix 3). The data analysis would identify the different types of risks affecting cost plans and would generally be followed by an evaluation of the project risk as a cost impact. The basis of risk evaluation is considered in the literature (e.g. Chapman, 2001) as usually being design information and project data. This is likely to be followed by identifying the types of external risks to which the project would be exposed.

In this section data obtained from survey Questions C3.2, A3.2, QS3.2 and E3.2 regarding cost impacts on the estimated cost plan is examined.[10] The results are presented in the four sub-sections already mentioned. These four variables were used because they were indicated by respondents in the preliminary analysis (see Appendix 3) to have a significant influence on cost planning. In the literature (e.g. Mok et al., 1997) it is argued that traditional estimating methods do not have the potential to incorporate risk in cost estimates and it was therefore necessary to investigate risk management in order to establish how to improve and enhance the existing practice of cost planning.

6.4.1.3 Data analysis of cost impact risk

In this first sub-section of Section 6.4.1, an overview of data received from survey questions relating to cost impact risk is presented, aimed at establishing information on the extent of cost impact risk in risk management and its influence on the budget assessment, as well as the nature of cost impact risk in building projects.

[10] Question 3.1 is dealt with in Section 6.4.2.

The examination of cost impact data was intended to establish the provision of risk management theory and practice for the quantity surveyor. For example, the literature Atkinson (1998), writing on factors influencing the magnitude of cost impacts in budget prediction, covers technical and managerial risks but does not consider risk factors or sources affecting risk management by the quantity surveyor. Based on the works of Chapman (2001) and Akintoye (2000), 23 building risk variables were examined and the results of seven significant cost contributors to cost impacts are tabulated in Tables 6.37 to 6.43.

6.4.1.4 Project risks

This is the second sub-section of Section 6.4.1 and in it the information gathered from the survey questions relating to project risks is examined to establish the nature and extent of project risks in cost plans. This examination was conducted in two parts:

- the size of the project risk
- the complexity of the project variables.

These two parts were chosen because the size of a project is the first physical characteristic that introduces the extent of work and materials to be used and type of building risk exposed during risk management, and because the complexity of the project is generally considered the focal point of any planning in construction projects (Gidado, 1996). Al-Momani (1996) and Senior (1990) have written further on the need for adequate consideration of critical risk sources for risk planning before project commences.

6.4.1.5 Size of project

Project size was chosen for examination due to the number of respondents who indicated it as an important source of building risk. Size also has a lot of influence on whether risk assessment in the project will be undertaken or not. It is generally considered in the literature (e.g. Macsporran and Tucker, 1996) that for a large building the checking of project information is done more closely without making many assumptions – as happens with small uncomplicated projects (Senior, 1990).

Table 6.37 reports on the stages of project development stages where cost impacts are examined against size of the project risk at feasibility stage.

Table 6.37 Cost risk impact of project size (Questions C3.2, A3.2, QS3.2 and E3.2)

Stage	Respondent firms and organisations				Total
	Client	**Architectural**	**QS**	**Engineering**	
Tender	5	3	5	3	16
Detail design	20	5	8	3	36
Sketch design	4	19	10	8	41
Feasibility	25	15	14	13	67
Inception	8	4	5	6	23
Total	62	46	42	33	183

Approximately a third (37%) of respondents considered the size of the project to have a cost risk impact on the estimate at feasibility stage. Surely supporting the presumption that all things being equal, the larger the project, the greater the cost impacts. Also a third of the client organisations indicated that they considered size of the project risk at detail design stage. It can be seen that 41% of the architects considered size of the project risk at sketch design stage, which compares closely with the one third of quantity surveying (33%) and engineering (39%) firms which considered size of the project risk at feasibility stage.

These results imply that only a third of the respondents considered size of project as having a cost risk impact on the estimate at feasibility stage. The larger the project, the greater the cost and the greater need for cost planning and risk management.

6.4.1.6 Complexity of project

The examination of complexity of the project risk was aimed at establishing the quality of risk management used in cost plans, and at determining the degree to which complexity influences the cost planning process The quality of data obtained would reflect the type of cost planning offered by the quantity surveyor.

In Questions C3.2, A3.2, QS3.2 and E3.2 respondents were asked to indicate whether or not complexity of the project has a cost impact on the estimated cost plan. The results are recorded in Table 6.38.

Table 6.38 Cost impact of project complexity (Questions C3.2, A3.2, QS3.2, E3.2)

Stage	Respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender stage	5	3	6	1	15
Detail design stage	19	5	5	7	36
Sketch design	7	22	8	6	43
Feasibility	28	11	17	12	68
Inception stage	5	5	6	5	21
Total	64	46	42	31	183

A third of the respondents (37%) indicated that complexity of the project has cost impacts on the estimate at the feasibility stage. Nearly a half (49%) of architectural respondents disagreed with the contention that cost impact assessment from project complexity should rather be considered at project inception and indicated that cost impacts should rather be considered at sketch design stage. Unlike the other respondents a third of the client firms (30%) indicated that they considered the cost impacts of complexity of the project at detail design stage.

The results shown in Table 6.38 contradict the literature on project complexity. For example, Akintoye (2000) and Gidado (1996) found complexity of the project to be among the significant factors in cost planning.

6.4.1.7 Information and data risks

In this third sub-section of section 6.4.1, design information and data risk of cost impacts are examined in order to reveal the practices of the client, architectural and engineering firms in obtaining information and data which enhance planning. The information elicited from the questionnaire was especially aimed at establishing the nature and extent of design information offered and provided for in the quantity surveyor's cost planning process.

The examination was conducted in two parts:

- quality of design information
- design variation

The analysis was conducted in these three sub-sections because, in the preliminary analysis, they had all been indicated by the respondents as factors influential to cost plans (see Questions C3.2, A3.2, QS3.2 and E3.2). In addition, the quality of information and data greatly affects cost planning, and the quality of design information and the subsequent design variation are considered in the literature (e.g. Senior, 1990) to have a great effect on estimated cost plans. Senior's viewpoint (1990) on clients' budget planning concerns the frequency of design variations, financial claims and uncertainty in the final estimated cost. Furthermore, the progress payment valuation was selected because the uncertainty connected with the final cost of a project is related the level of variation and the manner in which that valuation was conducted.

6.4.1.8 Quality of design information

The first part of this sub-section examines the effect of the quality of design information on costs generated in risk management, to establish the nature and extent of cost impact in the risk assessment. The cost plans used were those found to be important to the estimating process in the preliminary evaluation of risk variables.

It was established from the results shown in Table 6.38 that cost impact assessment was most important to the estimate at feasibility stage. However, the literature (e.g. Songer et al, 1997) shows that there are limitations on the information contained in the general financial statements produced at project inception. These do not include appropriate assessment of project risk and it was necessary to examine project information utilised in the determination of these financial statements and cost plans because the critical risks might not be known at the early project stages (Al-Momani, 1996) (see the results of table 6.8 on receipt of first budget information at feasibility stage). Al-Momani (1996) points to the need to improve on the quality of information used in current cost planning and risk management practices.

The respondents were asked (see Questions C3.2, A3.2, QS3.2 and E3.2) to indicate their opinions of the cost impact caused by the quality of the design information on the estimate, if it was to occur, at different stages of the project development.

The information provided from Questions C3.2, A3.2, QS3.2 and E3.2) is recorded in Table 6.39.

Table 6.39 Cost impact of quality of design information (Questions C3.2, A3.2, QS3.2, E3.2)

Stage	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender stage	13	3	3	3	22
Detail design stage	10	8	7	1	26
Sketch design stage	8	15	9	14	46
Feasibility stage	18	15	15	6	54
Inception stage	9	3	6	8	26
Total	58	44	40	32	174

Nearly one third of all respondents indicated that the cost impact on the estimated cost plan generated by quality of design information risk occurs at feasibility stage (Table 6.39). Two groups of architectural firms indicated that cost impacts on the estimated cost plans should be at either sketch design or feasibility stage. Engineers have input into the design process and they at times withhold design information awaiting the final design resolution. The engineering firms (44%) appear to agree with the architectural firms when they indicated that the cost impact on the estimated cost plan should be considered at sketch design stage.

6.4.1.9 Design variation

This second part of the sub-section examines design variation risk, to investigate the way in which design variation affects defined cost plans (as in Al-Momani, 1996). As the project develops there is an increase in information, so the design might be varied as the project is further defined.

The information obtained from Questions C3.2, A3.2, QS3.2 and E3.2 was an indicator of the type of service offered by the quantity surveyor. The information gathered is recorded in table 6.40. Approximately a quarter (28%) of respondents indicated that the greatest cost impact of the estimated cost plan was at feasibility stage. The client respondents showed that design variation risk had a cost impact both at feasibility and detail design stages.

Table 6.40 Cost impact of design variation (Questions C3.2, A3.2, QS3.2, E3.2)

Stage	Respondent firms and organisations				Total
	Client	**Architectural**	**QS**	**Engineering**	
Tender	7	6	4	1	18
Detail design	13	6	5	6	30
Sketch design	15	10	12	7	44
Feasibility	12	12	12	11	47
Inception	11	5	6	6	28
Total	58	39	39	31	167

The architectural firms distributed the cost impacts generated by design variation between sketch design and feasibility stages. The engineering and quantity surveying firms both said that cost impact on the estimated cost plan was mainly at feasibility and sketch design stages.

The interpretation of the result is that design variations should be anticipated and estimated cost plans increased at feasibility stage.

6.4.1.10 Valuations of future works

The final part of this sub-section examines the cost impact of the valuation for payments of future works, to determine the degree to which the accuracy of payment affects the estimating process. So far the discussion of the research has focused on pre-contract cost planning and control but future works valuation stages has its cost impacts on the estimated cost plans. The respondents were asked (see Questions C3.2, A3.2, QS3.2 and E3.2) to indicate the construction stage at which the cost impact of the estimate is affected by lack of accurate progress payment valuation. A firm's awareness of the cost impact on the estimated cost was seen by the researcher as likely to have a significant effect on the quality of service provided by the quantity surveyor.

The literature (e.g. Adams, 1997; Kaka, 1996) identifies discrepancies in progress payment valuation and interim payments. Payment delay was among the financial risk indicators regarded by Adams (1997) and Kaka (1996) as having an effect on the estimated cost plan and risk management practices in building projects. Therefore Questions C3.2, A3.2, QS3.2 and E3.2 asked respondents to indicate the cost impact on the estimated cost plan from 23 risk sources (see Appendix 3). Table 6.41 records their responses.

Table 6.41 Cost impact of valuation risk (Questions C3.2, A3.2, QS3.2, E3.2)

Stage	Respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender stage	22	7	11	5	45
Detail design	14	18	15	8	55
Sketch design	11	6	6	5	28
Feasibility stage	10	6	7	9	32
Inception stage	3	4	1	3	11
Total	60	41	40	30	171

Approximately a third of respondents (32%) indicated that the cost impact on the estimated cost plan generated by progress payment valuation risk was considered at detail design stage, and a further third of the client respondents indicated that it was at tender stage. A third of the engineering firms indicated that progress payment valuation risk was at feasibility stage.

The implication is that the assessment of cost impacts on the cost plans generated by progress payment valuation should be considered at detail design stage. This is because of the type of progress payment requirements that depend on multiple quantitative factors are difficult to assess without project details.

6.4.1.11 External risks

This fourth and final sub-section of section 6.4.1 relates to survey Questions C3.2, A3.2, QS3.2 and E3.2 and examines the nature and extent of external risks in cost impact assessment. The researcher's view of external risks is that they affect the design and building process in which an estimate might be prepared. Thus respondents were asked to indicate, at different building stages, the cost impact of each of a given list of risk sources or factors (if they were to occur).

The examination was conducted in two parts:

- political uncertainty
- interest rate changes in the building market.

These variables were chosen by the researcher because the preliminary analysis showed that they were regarded by the respondents as being the two most important in risk management.

6.4.1.12 Political uncertainty

The indication from the respondents in the preliminary analysis was that political uncertainty risk was a significant risk to cost planning and risk management.

Respondents were asked to indicate their selection of the stage of cost compacts on the estimated cost plan caused by political uncertainty risk. The information gathered is summarised in Table 6.42.

Table 6.42 Cost impact of political uncertainty (Questions C3.2, A3.2, QS3.2, E3.2)

Stage	Respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender stage	11	2	4	3	20
Detail design	21	12	3	7	43
Sketch design	18	16	13	5	52
Feasibility stage	4	7	18	9	38
Inception stage	5	4	2	7	18
Total	59	41	40	31	171

These results indicate a fair spread for most respondents, with clients tending to indicate later stages and quantity surveyors mainly saying that the impact would be earlier – at feasibility or at sketch design stage.

The results imply that political uncertainty has an impact on the estimated cost plan at both feasibility and detail design stages.

6.4.1.13 Interest rate changes

The extent to which interest rate changes affect a project varies from project to project. The section is aimed at examining the respondents' awareness of market changes that might have a cost impact on the estimated cost plan due to the temporal nature of building risk. Questions C3.2, A3.2, QS3.2 and E3.2 asked respondents to select either the interest rate changes risk variable or the other risk sources that have a cost impact on the estimated cost plan. Table 6.43 records the number of respondents who selected the interest rate change variable as having a cost impact on the estimated cost plan at each stage.

Table 6.43 Cost impact of interest rate changes (Questions C3.2, A3.2, QS3.2, E3.2)

Stage	Respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender stage	8	6	4	5	23
Detail design	19	12	4	6	41
Sketch design	16	12	17	6	51
Feasibility stage	10	9	13	12	44
Inception stage	5	1	2	2	10
Total	58	40	40	31	169

The results in Table 6.43 indicate that the assessment of cost impact on the estimated cost plan generated by interest rate changes was clients and architectural firms most often consider the impacts at late design stages while quantity surveyors and engineers consider them at feasibility stage.

This implies that when cost impact from interest rate changes are considered, this should be done at early cost planning stage, while the client is still considering future project expenditure.

6.4.2 Frequency of risk occurrence

In this section (Section 6.4.2), the frequency of risk occurrence is examined to establish its nature and extent in cost planning. In the risk management literature (e.g. Edwards, 1995) the cost impact of the risk and its frequency of occurrence are generally considered together when evaluating risks in building projects.

As suggested in the literature (e.g. Edwards, 1995), the frequency of risk occurrence in building projects undoubtedly varies from project to project. In this section the frequency of risk occurrence in the risk assessment process is examined. Questions C3.1, A3.1, QS3.1 and E 3.1 asked respondents to select and indicate the stage of occurrence of the listed risk.

The examination of the frequency of risk occurrence is presented in three parts, covering the following areas:

- data analysis relating to the frequency of risk occurrence
- client and professional team risk
- experience and market conditions risk.

The frequency of risk occurrence was chosen because it is important to establish the probability of an adverse event occurring before arriving at a suitable type of response to that risk.

Client and professional team risks are considered because, in the opinion of the researcher, they are mainly caused by omissions on the part of the building team comprising the client, architect and the quantity surveyor.

Lastly, experience and market conditions risk were seen by the researcher to be important to cost planning in the preliminary analysis. Experience and market conditions factors were also noted in the literature (e.g. Zelouf, 1995) as influencing cost assessment in building projects.

This sub-section is a follow up of cost impact analysis data and, due to the importance of frequency of occurrence risk in risk assessment, the researcher thought it important to focus on the data derived from the frequency of risk occurrences after establishing the nature and extent of cost impact risk on the estimating process in Section 6.4.1.

The researcher decided to examine the frequency of occurrence risk that relates to risk management in the cost planning and control process, to gauge the extent of risk management practised by quantity surveying respondents in establishing cost plans for building projects.

6.4.2.1 Data analysis of frequency of risk occurrence

This first sub-section of Section 6.4.2 provides an overview of the provision of frequency of occurrence data obtained from the survey questions relating to risk management. Edwards (2001) and Diekmann et al. (1988) argue that building risk has repetitive and temporal characteristics that should be considered during risk assessment. Basing the data analysis on 23 risk sources and factors, eight variables concerning frequency of risk occurrence were noted as indicated by the respondents as having a significant influence on cost planning and risk management (see Appendix 3). From these, the three most significant variables were selected for examination. These were design completeness, brief uncertainty and the estimator's experience. The results are given in Tables 6.44 to 6.47.

6.4.2.2 Client and professional team risk

In this second sub-section of Section 6.4.2, the provision of client/professional team risk in the cost planning process is presented, aimed at establishing its nature and extent in cost plans. The examination was conducted in two parts:

- frequency of design completeness risk
- frequency of brief uncertainty risk.

The respondents in the preliminary analysis indicated a high frequency of risk occurrence from completeness of design work risk and therefore the design risk variable was selected to illustrate the current practice. In addition, the frequency (or rather the infrequency) of design completeness was shown in the literature (e.g. Senior, 1990) to be a major cause of risk in building projects and as having a significant influence on cost planning.

An awareness of the frequency of brief uncertainty risk was noted by Chapman (2001) as the first step in project knowledge acquisition, based on understanding project objectives.

The client and professional team is expected to provide project information but they may be limited by the time allocated to estimating activity (Hagazy and Moselhi, 1995). In such situations the estimator has to use the limited data sources provided by the client and professional team to establish alternative methods of risk identification for the project cost planning process.

6.4.2.3 Frequency of design completeness risk

This first part of the client/professional team risk sub-section deals with the frequency of occurrence of risk in the provision of the estimate in the early project stages (Edwards, 1995). The frequency of occurrence of likely risks was sought from respondents and investigated to form practices of the likely cost impacts in cost planning.

Senior (1990) suggests that completeness of design is a risk component in building contracts. The respondents were asked (see Questions C3.1, A3.1, QS3.1 and E 3.1) to indicate the frequency with which the listed risk factors occurred. The results are recorded in table 6.44.

Table 6.44 Frequency of design completeness risk (Questions C3.1, A3.1, QS3.1, E 3.1)

Stage	**Number of respondent firms and organisations**				Total
	Client	**Architectural**	**QS**	**Engineering**	
Tender	8	5	3	2	18
Detail design	15	7	8	5	35
Sketch design	12	16	9	6	43
Feasibility	11	12	17	12	52
Inception	14	4	4	6	28
Total	60	44	41	31	176

Approximately a quarter of the respondents (29%) indicated that design completeness risk frequently occurred at feasibility stage. In the opinion of the clients, design completeness risk occurs more frequently at detail design stage. The architectural respondents indicated that design completeness risk occurred frequently at sketch design stage. The quantity surveying and engineering firms indicated that it occurred frequently at feasibility stage.

The data in Table 6.44 imply that design completeness risk frequently occurred at feasibility stage. This is in keeping with the literature (e.g. Kaming et al., 1997; Al-Momani, 1996) which suggests that one of the causes of inaccuracy of estimates and is inadequate cost planning, while Senior (1990) blames it on the incomplete designs offered in the building industry.

6.4.2.4 Brief uncertainty

This second part of the sub-section on client or professional team risk examines the frequency of occurrence of brief uncertainty risk in the planning process. Given the inadequate planning referred to in the literature (e.g. Loosemore, 1993) and, frequently, the inability of estimators to obtain comprehensive briefing from the client, it would be expected that the design team could supply comprehensive design details at early project stages.

Table 6.45 Frequency of brief uncertainty risk (Questions C3.1, A3.1, QS3.1, E3.1)

Stage	Number of respondent firms and organisations				Total
	Client	**Architectural**	**QS**	**Engineering**	
Tender	9	6	4	4	23
Detail design	13	9	9	5	36
Sketch design	19	15	5	6	45
Feasibility	18	12	15	12	57
Inception	2	1	8	4	15
Total	61	43	41	31	176

Therefore, in order to ascertain the nature and extent of brief uncertainty risk in planning, the respondents were asked to indicate cost practices relating to the frequency of occurrence of briefing risk arising from information provided from the building project. The information received was taken as an assessment of the utilisation of the client brief in risk management of the building project. Table 6.45 records the numbers of respondents who answered Questions C3.1, A3.1, QS3.1 and E3.1 on brief uncertainty risk.

One third (32%) of respondents indicated that brief uncertainty risk frequently occurred at feasibility stage. Client and architectural firms indicated that brief uncertainty risk occurred most frequently at sketch design stage. The engineering and quantity surveying firms seem to have indicated that brief uncertainty risk was frequent at feasibility stage.

The result implies that brief uncertainty risk occurs more frequently at feasibility stage, but is thought to be present at sketch design stage.

6.4.2.5 Experience risk and market conditions risk

This third and last sub-section of section 6.4.2 examines the frequency of occurrence risk generated by the experience (or rather the inexperience) of the quantity surveyor, as well as market conditions risks in the planning process. This was done to establish a basis for interpreting the quality of service offered by the quantity surveyor. Thus this sub-section presents information gathered from survey questions relating to market trends and the experience necessary to assess these costs. The examination of the data was aimed at establishing the nature and extent of external factors affecting building risk assessment. The collected data was regarded as an indicator of the experience of the quantity surveyor with regard to market conditions in cost planning.

In an attempt to establish the problems associated with experience of the quantity surveyor in cost planning, the researcher requested client, architectural and engineering firms to indicate their perception of cost practices and the service they receive from quantity surveyors (see Questions C3.1, A3.1, QS3.1 and E3.1). These respondents were also asked to indicate the frequency with which the listed risk factors occurred at different construction stages.

The examination was conducted in two parts:

- quantity surveyor's experience
- inflation risks and market conditions risks.

These two variables were chosen because the literature on risk management (e.g. Kaming et al., 1997) has established that they are highly significant in risk management. The investigation was aimed at determining the quality of the risk management process. This involves the planning practices which the quantity surveyor offers to clients in building projects.

6.4.2.6 Quantity surveyors' experience

This first part of the sub-section examines the problems of the experience of estimator risk faced by client, architectural, quantity surveying and engineering firms. According to Akintoye (2000) and Kaming at al. (1997), experience on different types of projects was lacking from those responsible for estimating functions. For that reason the researcher selected the experience of estimator risk for examination since it relates to the estimating practices of risk management in cost planning and control. Questions C3.1, A3.1, QS3.1 and E3.1 asked respondents to indicate the frequency with which the estimators' experience risk occurred during the different stages of the project. The results are reported in Table 6.46.

Table 6.46 Frequency of estimators' experience risk (Questions C3.1, A3.1, QS3.1, E 3.1)

Stage	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender	2	2	3	2	9
Detail design	28	7	8	5	48
Sketch design	10	23	14	2	49
Feasibility	13	9	14	13	49
Inception	7	2	3	9	21
Total	60	43	42	31	176

Approximately a quarter (29%) of the respondents indicated that estimator experience risk occurred frequently at feasibility and sketch design stages (Table 6.46), and 27% indicated that this risk occurs at detail design stage. Client respondents (47%) indicated that the experience of estimator risk occurs frequently at detail design stage. The majority (53%) of architectural firms indicated that they find it occurs at sketch design stage. A third of the quantity surveying and engineering firms indicated that their experience of estimator risk occurred most frequently at feasibility stage

The results shown in Table 6.48 imply that occurrence risk occurred most frequently at feasibility stage.

6.4.2.7 Inflation and market conditions

This second part of the sub-section examines the extent and nature of the effect of market conditions risks on cost plans. This was aimed at better understanding the frequency of occurrence of selected risk factors – for proactive risk management. Proactive anticipation of inflation, market shortages and poor tender conditions can have great cost impacts and should happen during the design stage. Moreover, by project development stage, price trends might not be sufficiently addressed to allow an assessment which would cover the whole construction period.

At construction stage, market condition risks can be volatile when a project is exposed to external influences. For example, unexpected prices and changes of material are likely to affect costs, due to shortages and non-availability of materials of the recommended quality. The experience of estimator risk occurs when the formulation of a cost plan takes place under uncertain inflation and market conditions.

Available project information is often limited because current practices are not adequate for coping with changing market price trends (Zelouf, 1995). Therefore Questions C3.1, A3.1, QS3.1 and E3.1 focused on the frequency of occurrence of risk factors in the risk management and cost planning processes.

Table 6.47 Frequency of inflation and market conditions risk (Questions C3.1, A3.1, QS3.1, E3.1).

Stage	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender	7	10	7	3	27
Detail design	22	19	8	4	53
Sketch design	17	8	7	8	40
Feasibility	13	4	16	10	43
Inception	3	1	2	7	13
Total	62	42	40	32	176

In an endeavour to establish the nature and extent of inflation and market conditions, the opinions of the respondents were sought regarding utilisation of market data in the cost planning process. The results obtained are given in Table 6.47.

Table 6.47 shows that nearly one third of the (30%) client respondents indicated that inflation, market and tender conditions risk occurred most frequently at detail design stage, and 40% of the quantity surveying firms indicated that they occurred at feasibility stage. Nearly half (45%) the architectural firms indicated that these risks were most frequent at detail design stage, there agreeing with the client respondents. In contrast the quantity surveying (40%) and engineering (31%) firms indicated that the frequency of occurrence of market conditions risk was greatest at feasibility stage.

6.4.3 Response risk in risk management

In this section (section 6.4.3), response risk in risk management is examined to establish its nature and extent in cost planning. The information obtained is used to interpret the type of risk responses offered by the quantity surveyor in cost planning.

The section provides an overview of the nature and type of response to risk impacts used by quantity surveyors in cost planning. The examination of response risk in the practice of cost planning and control process was conducted in two parts:

- data analysis of response risk
- risk sources and factors, and responses to them.

The rationale for conducting the examination in these two parts was, firstly, that data analysis is seen as important to decision making, particularly when responding to building risk. Without first identifying the risk it is almost impossible to know the best response to a particular risk.

As regards the second sub-section, the opinions of respondents were sought by using a list of risk sources and factors. Questions C3.3, A3.3, QS3.3 and E3.3 asked them to choose typical responses from listed risk factors. The researcher has chosen to omit those risk factors which were indicated as not having much cost significance. Some of the factors were identified as influenced by the frequency of occurrence risk. However, the researcher could not investigate all these risks and therefore the basis of selection from 23 variables was the major risk variable for examination, namely; the timely completion of the final account risk.

6.4.3.1 Data analysis of response risk

This first sub-section of Section 6.4.3 presents an overview of data received from survey questions relating to response risk. It is aimed at establishing information on the nature and extent of this risk in risk management. Miller and Lessard (2001) and Ranasinghe (1998) believe that strategies for dealing with response risk should be developed early at project inception. Therefore designers using theory and project understanding can determine the anticipated cost in advance and increase the budget proportionately. In some projects quantity surveyors can anticipate a known risk to have a particular outcome, and so such a risk would be determined in advance. Risk variables identified from the risk management literature (e.g. Akintoye, 2000) were formulated into a questionnaire and the respondents were asked to indicate their type of response for 23 risk sources variables that rose from the different construction stages.

In order to respond to a perceived financial risk, the cost adviser must check its cost impact and make an appropriate response, depending on the frequency of occurrence of that risk and the size of its probable impact (Ward, 1999). It was therefore necessary to examine response risk in cost planning. The respondents indicated the type of response implemented in their projects which they thought would affect its final cost (see Questions C3.3, A3.3, QS3.3, E3.3). These opinions were summarised to permit the examination of possible relationships between the risk and the response provided by the quantity surveyor.

6.4.3.2 Risk sources and factors, and responses to them

This second sub-section of section 6.4.3 is based on an overview of the responses to survey questions relating to response risk at different development stages. It includes data from questions C3.3, A3.3, QS3.3 and E3.3 on response risk in cost planning. The literature (e.g. Adams, 1997; Kaka, 1996) mentions inadequate responses from the client's cash flow to lack of capital project funding and poor responses to non-availability of accurate data on which the estimator could peg future building activities. In an endeavour to establish the nature and extent of responses to risk in the planning process, respondents were asked (see Questions C3.3, A3.3, QS3.3 and E3.3) to indicate the different stages at which they responded to different risk sources and factors. This showed that responses to risk in the cost planning process do exist but that risk allowances could be incorporated into the estimate to cover risk occurrences.

Future cash flow projections are generally based on cost assessments that are dependent on the timely evaluation and completion of the final account. After completion of the final account, financial shortcomings of previous projects could be used for future predictions. Therefore, a response to final account valuation risk was selected from the preliminary analysis as having significant influence on cost planning factor in building projects. Seven significant risk variables were ignored by the researcher because they were similar to those described in the previous sections on cost impact and frequency of occurrence risk. The result of one variable – which was shown in the preliminary analysis to have a significant influence on cost planning – was deemed by the researcher to satisfy the link to the cluster of significant risks in risk management (see Appendix 3). This variable is:

- timely completion of final account risk.

The 'timely completion of the final account' variable was selected because of its influence on risk management and cost planning, and because it was indicated by respondents in the preliminary analysis to have significant response (see Appendix 3). Another reason for selecting this variable was that it had been previously omitted by the researcher from the group of cost significant factors.

6.4.3.3 Timely completion of final account

The section establishes the type of response to risk problems that occur caused by the timely completion of final account risk and future cost impacts of financial claims.

In this part of the response risk data analysis, to timely completion of final account risk is examined, to help understand the nature and extent of final account risk as it influences cost planning. Timely completion of final account risk is examined, selected as an example, representing financial impacts that occur as a result of cost planning and control service provided by the quantity surveyor in Kenya.

The literature (e.g. Chapman, 2001) notes that a response to risk is needed to produce meaningful cost and risk planning, and the timely completion of final accounts of projects is an important source of financial claims. For this reason, dependency on previous financial claims to estimate timely completion of final account risk was chosen for examination. The basis for the selection was that the timely completion of the final account of previous projects was noted to affect future project cost planning and control.

Questions C3.3, A3.3, QS3.3 and E3.3 requested all respondents to indicate the typical response listed risk sources. The results for the 'timely completion of the final account risk' are shown in Table 6.48.

Table 6.48 Timely completion of final account risk (Questions C3.3, A3.3, QS3.3, E 3.3)

Responses	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Retain and increase budget	18	6	3	5	32
Change design to accommodate and reduce impact	20	15	17	11	63
Transfer (insurance)	11	4	11	4	30
Avoid (i.e. redesign)	6	10	5	6	27
Do not know	2	5	2	5	14
Total	57	40	38	31	166

Table 6.48 shows that 45 per cent of the quantity surveying firms had indicated that a change of design to accommodate and reduce cost impact is the typical response to timely completion of final account risk.

The implication of the finding was that, timely completion of final account risk, as an example of financial risks, was responded to by changing design to reduce the cost impact. It is not surprisingly that other respondents do support that type of response to future building risk.

The results in Table 6.48 also imply that risk avoidance to timely completion of final account risk was not a typical response to financial risk as was expected by the researcher.

6.4.4 Summary of risk management in cost planning and control

In this section a summary is presented of the practice of risk management in cost planning and control.

- *The examination was conducted in three parts, namely cost impacts, frequency of occurrence and response risks.*

  The size and complexity of project risks was found to have cost impacts on the estimated cost plan, most often at feasibility stage.

  The quality of design information risk was found to have cost impacts on the estimated cost plan most often at sketch design and feasibility stages.

  For architectural firms, the cost impacts generated by design variation risk occurred most often at sketch design and feasibility stages; for engineering and quantity surveying firms they occurred most often at sketch design stage.

  One quarter of quantity surveying firms indicated that cost impacts on the estimated cost plan caused by progress payment valuation risk occurred most often at tender stage, and a third of engineering firms indicated that they occurred at feasibility stage.

- *Design completeness risk occurred most frequently at sketch design stage. The quantity surveying and engineering firms indicated that design completeness risk occurred most frequently at feasibility stage.*

- *For quantity surveying (40%) and engineering (31%) firms the frequency of occurrence of market conditions risk occurred most often at feasibility stage.*

- *The quantity surveying and engineering firms indicated that they most often responded to final account risk at detail design stage.*

- *Implications of the findings are dealt with later in the discussions.*

Cost impacts generated by significant risk factors require further clarification. The question becomes: 'Why is it not possible to assess these risks proactively, based on known cost impacts and the frequency of occurrence risk?' It should be noted that the issues of cost impact risk, frequency of occurrence risk and response risk are further addressed in Chapter 8.

6.5 Treatment of risks in cost planning and cost control

In this section, questions from the survey relating to the cost planning process and to the treatment of potential risks in risk management are examined, to establish the nature and extent of the current treatment of potential risks in cost practice. The examination is conducted in two sections, namely; assessment risk in the treatment of potential risks (Section 6.5.1), and communication risk in the treatment of potential risks (Section 6.5.2).

These two sections were chosen because of the significance accorded to the treatment of potential risks in risk management literature (e.g. Kim and Bajaj, 2000). The size of the impact must be known before feasible risk responses are made regarding any building risk (Ward, 1999). Although at project inception there may not be any knowledge of future building states, and various pieces of information will still need to be communicated to the quantity surveyor for cost planning purposes, the quantity surveyor still has an obligation to the building client of producing an estimate of the works (Pender, 2001).

In an endeavour to seek information on the treatment of potential risks, respondent opinions were sought (see Questions QS2.2 to 2.5, C4.1 to 4.4, A4.1 to 4.4, QS4.1 to 4.4 and E4.1 to 4.4) regarding the treatment of potential risk and the techniques they used in their projects.

6.5.1 Assessment risk in the treatment of potential risks

In this section (section 6.5.1), the survey questions relating to assessment risk in the treatment of potential risks are examined to establish the nature and extent of these risks. The information obtained was aimed at providing a basis for interpreting the service offered by quantity surveyors in risk assessment of estimated cost plans.

The examination is conducted in four sub-sections:

- data analysis of assessment risk in the treatment of risks
- risk management theory and practice
- estimating methods
- risk analysis techniques.

Data analysis was used in order to identify assessment risk in the treatment of potential risks, and as a basis for identifying assessment risk in building projects.

Risk management theory and practice is the focus of any risk assessment – as suggested in the literature (e.g. Ranasinghe, 1998).

Traditional estimating methods are still the basis of risk assessment of outcomes and guide the quantity surveyor regarding the cost of unexpected events – so that expenses towards it can be incorporated into the project budget (Loosemore, 1993). The rationale for examining risk analysis techniques is that traditional estimating methods alone are not adequate, and relevant to risk analysis. Qualitative methods need to be used in estimating to enhance the cost planning process (Songer et al., 1997).

To examine assessment risk in cost planning process and risk management, the issue of treatment of potential risks was considered in ascertaining the information offered by quantity surveyors in budget prediction. All respondents were asked about their practices (see Questions QS2.2 to 2.4, C4.2 to C4.4, A4.2 to A4.4, QS4.2 to QS4.4 and E4.2 to E4.4) regarding risk assessment in their current projects. The information obtained is reported in tables 6.49 to 6.56.

6.5.1.1 Assessment risk in the treatment of potential risk

This first part of Sub-section 6.5.1 provides an overview of the analysis of assessment risk in the treatment of potential risk. Assessing risk is a decision-making process needing participant co-operation and project information (Corriea et al., 2000). The literature on risk management has concentrated on cost modelling for potential risks (e.g. Al-Tabtabai and Alex, 1998) or cost assessment of the cost significant risks (e.g. Chapman, 2001) or using fuzzy logic (e.g. Tah and Carr, 2000), but these methods have limited applications. The quantity surveyor has to seek information from other sources when assessing building risk at the early stages of the project.

To establish the nature and extent of assessment risk in the treatment of potential risks in the cost planning process, 43 variables were used. Of these, eleven were chosen for their cost relevance to the treatment of potential risk (Tables 6.58 to 6.68) and to cost assessment risk.

The rationale for selecting these eleven variables was that the respondents considered them to be important to cost planning, as indicated by results from the preliminary data analysis (Appendix 3).

6.5.1.2 Risk management theory and practice

In this second part of Sub-section 6.5.1, familiarity with risk management theory and its application is examined, to establish its nature and extent in the practice of cost planning. Mok et al. (1997) concluded that cost planners have not extensively adapted risk analysis techniques in preparing cost estimates. Therefore, the issue of respondents' familiarity with risk management risk was selected to illustrate experience in risk management theory and its applications.

The examination of the data for risk management theory and practice is conducted in two parts:

- familiarity with risk management theory
- experience in applying risk management.

The examination consists of these two parts because it has been noted by Kim and Bajaj (2000) that participants in building projects do not use risk management techniques, due to lack of familiarity with risk management concepts, as well as a lack of practical knowledge of the construction process by those responsible for the estimating functions (Akintoye and Fitzgerald, 2000).

The literature on risk management, for example Elkington and Smallman (2002) and White and Fortune (2002), points out that previous risk experience and staff knowledge were often not capitalised on in risk management. A consequence of lack of experience can be that potential risks which should be assessed are not even noticed.

6.5.1.3 Familiarity with risk management theory

In this first part of the sub-section on assessment risk, information gathered from Questions C4.1, A4.1, QS4.1and E4.1 is used, to discover how familiar respondents were with the theory of risk management. Table 6.49 gives the number of respondents and their responses.

Table 6.49 Familiarity with risk management (Questions C4.1, A4.1, QS4.1, E4.1)

Familiarity with risk management theory	**Number of respondent firms and organisations**				Total
	Client	**Architectural**	**QS**	**Engineering**	
No	23	20	14	20	77
Yes	43	25	25	1	94
Total	66	45	39	21	171

The majority of clients (65%), quantity surveying (64%) and architectural (55%) firms claimed to be familiar with the theory of risk management. Surprisingly, nearly all of the engineering firms who responded to the question indicated that they were not familiar with the theory of risk management.

These results are not in full agreement with the literature (e.g. Akintoye and Fitzgerald, 2000), which suggests that there is a lack of knowledge of risk management concepts and methods from those responsible for costing functions.

6.5.1.4 Experience in applying risk management

In this second part of the sub-section, experience in risk management practice is examined. The information gathered from the second parts of Questions C4.1, A4.1, QS4.1 and E4.1 was aimed at finding out practitioners' experience in the assessment and treatment of potential risks. The results are shown in Table 6.50.

Table 6.50 Experience with risk management applications (Questions C4.1, A4.1, QS4.1, E4.1)

Experience with management applications	**Number of respondent firms and organisations**				Total
	Client	**Architectural**	**QS**	**Engineering**	
No	23	20	22	18	83
Yes	41	25	20	0	86
Total	64	45	42	18	169

Half of the quantity surveying respondents (52%) and 100% of engineering respondents reported that they were not experienced in the practice of risk management. However, 64% of the client and 56% of architectural respondents reported that they did have such experience.

The results shown in Table 6.50 indicate that the majority of practitioners are of the opinion that they possessed experience in the practice of risk management, which was again at odds with established literature (e.g. Kaming et al.1997) which concludes that there is a lack of experience in different types of project risk.

6.5.1.5 Estimating methods

In this third sub-section of Section 6.5.1, the survey responses on the issue of estimating methods is examined to establish the nature and extent of risks generated by estimating methods used by the quantity surveyor. This examination was conducted in three parts:

- approximate quantities as the preferred estimating method
- the stage at which this method is applied
- the price rates utilised in costing the quantities.

Approximate quantities was examined as an estimating method because the literature notes that it is used frequently by quantity surveyors (Bowen,1993; Brandon and Newton, 1986).

The stage at which the estimate is executed was chosen for study because it is generally considered in the literature to be important to the accuracy of the estimated cost plan (Pedwell et al., 1998) as for the guidance of the client and design team.

Lastly, the different cost rates used by quantity surveyors have been found in the literature to vary from current market prices (Zelouf, 1995), because of limited exchange of information among participants, presumably to maintain a competitive advantage.

Awareness of the theory of risk management in the practice of cost planning has been established in the literature (e.g. Mok et al., 1997), although the degree of familiarity with risk management and application appears to be minimal (Akintoye and Fitzgerald, 2000). The researcher therefore decided to examine estimating methods used by the quantity surveyor in cost plans.

6.5.1.6 Approximate quantities

This first part of the sub-section on estimating methods deals with approximate quantities. This is one of the methods used by the quantity surveyor in the cost planning process and this examination is aimed at establishing the nature and extent of its use. Bowen (1993) and Brandon and Newton (1986) found that quantity surveying firms used approximate quantities frequently in cost assessment, and at different stages of the project. The literature on this subject also called for a refinement of cost prediction methods, to improve the cost assessment process (Edwards, 2001).

Table 6.51 Use of approximate quantities method (Question QS2.2)

Use of approximate quantities as preferred estimating technique	Number of QS firms
Always	23
Occasionally	14
Seldom/never	1
Total	38

The first part of this Sub-section (on estimating methods) is an attempt to understand the preferred estimating method in the provision of cost planning. In question QS2.2, quantity surveying respondents were asked to select from a list of methods the one they use to provide estimates of final building costs. The question was aimed at finding the frequency of use of the approximate quantities method, in an attempt to show the use of incomplete and inadequate project information. The results, which are shown in Table 6.51, were used by the researcher as a method for establishing cost plans.

The great majority of quantity-surveying respondents (83%) reported that they always used the approximate quantities method to provide an estimate of the final building cost.

6.5.1.7 Stage of application

This second part of the sub-section on estimating methods investigates the stage at which approximate quantities are applied to the treatment of potential risk. To the researcher it seemed necessary not only to establish the methods of estimating preferred by the quantity surveying firms, but also to ascertain the stage of application of each method. The approximate quantities method was suggested in the literature (e.g. Brandon and Newton, 1986) as needing the minimum information to produce an effective cost plan, and quantity surveyors usually resort to this method to solve immediate estimating needs, while detailed planning is expected to follow later.

Question QS2.4 requested the quantity surveying firms to select from the list of estimating methods those preferred for use in their offices, and to give the stage at which they used them. Table 6.52 records the stage at which they use approximate quantities method.

Table 6.52 Stage of application of approximate quantities method (Question QS2.4)

Preferred stage of application for approximate quantities method	**Number of QS firms**
Tender	31
Detail design	7
Inception	2
Total	40

A large majority of quantity-surveying respondents (78%) said they preferred to use the approximate quantities method at tender stage to provide the estimate of final building cost (Table 6.52).

This preference for using the approximate quantities method appears to ignore the ideas of Morrison (1983), who advocated proactive budget prediction techniques, and suggests that quantity surveyors should not be passive in their estimating functions but rather should be proactive in guiding project expenditure with the methods they use at inception and detail design stages.

6.5.1.8 Price rates used in cost estimates

The price rates utilised by quantity surveyors in the costing of quantities, particularly when using the bills of quantities method in estimating cost plans, are now examined in this third part of the estimating methods sub-section. In the assessment of risk, the practitioner has to use price data from the building market to provide the client with adequate financial guidelines. When ascertaining which price rates to use, the nature of price data must first be established. Question QS2.5 asked quantity surveying firms to choose – from a given list – the methods they used to determine the price rate in order to compile the estimates. Table 6.53 presents the results.

Table 6.53 Price rates risk in the bills of quantities method (Question QS2.5)

Method for determining price rates for bills of quantities	**Number of QS firms**
Price obtained from previous projects	23
First principles	1
'Gut feel'	3
Price books	1
Projects updated for inflation and market conditions	1
Total	29

The great majority of respondents (80%) used the bills of quantities method with rates compiled from in-house prices, obtained from previous building projects (Table 6.54).

This result contradicts the literature (e.g. Zelouf, 1995) that the cost estimate should relate to prevailing bid market rather than recalling price rates from previous projects or the use of historical data.

6.5.1.9 Risk analysis

In this sub-section of Section 6.5.1, the survey question regarding alternative methods of assessing risk is examined to determine the nature and extent of the provision of treatment of potential risk. Cost plans are usually based on traditional single-value estimates (Mok et al., 1997), so the researcher decided to examine the application of risk analysis tools developed to enhance the assessment of risk allowances in such plans. Contingency sum allowances in the final estimated cost do not cater for costing of risk events associated with complex building projects.

In Questions C4.3, A4.3, QS4.3 and E4.3 respondents were asked to indicate their risk analysis practices. Question QS4.3 asked quantity surveying respondents to indicate whether they used any of the provided risk analysis techniques for assessing the risk component of the final building cost. Questions C4.3, A4.3 and E4.3 asked the other respondents to indicate which of the listed risk analysis techniques they expected their quantity surveyor to use when estimating building cost.

The examination of the nature and extent of utilisation of risk analysis techniques is conducted in three parts:

- the utilisation of intuition/judgement/experience
- the utilisation of probability analysis
- the stage at which intuition/judgement/experience is applied.

The first of these three parts was chosen because the intuition/judgement/experience method has been found in the literature (e.g. Kim and Bajaj, 2000) to be used by construction managers in making cost planning decisions. The technique is especially important in circumstances where there is a lack of project information.

The utilisation of probability analysis – applied by the quantity surveyor in cost planning – is rooted in a probability-based paradigm that has costing limits, and takes account of the cost practitioner's inability to explain cost planning practices and project cost parameters (see Pender, 2001).

Lastly, the stage at which intuition/judgement/experience is applied was seen as being important to the quantity surveyor due to the influence that the construction stage has on the amount of information made available for starting the necessary risk analysis and any subsequent risk management.

6.5.1.10 Using intuition and experience

It is important that the methods used in risk assessment should increase the reliability of the risk management. This first part of the Sub-section on risk analysis examines how respondents used their intuition, judgement and/or experience in assessing risk in building projects, to establish the nature and extent of the risk analysis techniques used by the quantity surveyor. The survey questions relating to the practice of risk analysis are analysed to establish the nature and extent of the use of risk analysis methods by quantity surveyors.

In the literature (e.g. Kim and Bajaj, 2000) it was noted that Korean construction managers made decisions based on their intuition, judgement and experience and the current research aimed to find out whether the same practice applied in Kenya – in other words it aimed to determine whether practitioners used their judgement/intuition/ experience as a rates-selection method, and whether the rates they arrived at were suitable or not.

The respondents were asked (Questions C4.3, A4.3, QS4.3 and E4.3) to select, from a list of possible techniques, their own practices regarding intuition, judgement and experience. The results are shown in Table 6.54.

Table 6.54 Use of judgement, intuition and experience (Q's C4.3, A4.3, QS4.3, E4.3)

Use of intuition/ judgement in risk analysis	**Number of respondent firms and organisations**				Total
	Client	**Architectural**	**QS**	**Engineering**	
Seldom/never	4	5	11	3	23
Occasionally	17	10	0	9	36
Always	39	27	28	17	111
Total	60	42	39	29	170

As can be seen from Table 6.54, the majority of respondents (65%) would expect the quantity surveyor to use intuition, judgement and/or experience in assessing the risk component of a final building cost. The client, engineering and architectural firms said that they very often expected the project quantity surveyor to use this method, but fully a quarter of the quantity surveying firms said that they seldom or never used their intuition/judgement/ experience to assess the risk component of a building cost.

The implication of the result was that the quantity surveyor was not supported with project details and concepts but was left to personal intuition and experience.

6.5.1.11 Probability analysis method of risk evaluation

In this second part of the sub-section on risk analysis, the use of probability analysis as an alternative method of risk analysis is examined since the researcher expected this method to be popular among quantity surveyors and other practitioners (see Pender, 2001). The opinions of respondents were sought (Questions C4.3, A4.3, QS4.3 and E4.3) to establish whether or not they used this technique. The results given in table 6.54 show the content to which the respondent was expected to use probability analysis.

Table 6.55 Use of probability in risk analysis (Questions C4.3, A4.3, QS4.3, E4.3)

Frequency of use of probability analysis	**Number of respondent firms and organisations**				Total
	Client	**Architectural**	**QS**	**Engineering**	
Seldom/never	12	14	12	3	41
Occasionally	27	18	16	14	75
Always	16	6	4	11	37
Total	55	38	32	28	153

Nearly half of the all the respondents (49%) reported that they only occasionally used probability analysis for assessing the risk component of a final building cost. A third of the engineering firms always used it. The vast majority of the quantity surveying firms (88%) stated that they use probability analysis at most only occasionally.

6.5.1.12 Stage of application of risk analysis

This is the third part of the sub-section on risk analysis. It examines the stage at which intuition/judgement/experience is used.

The analysis was done after establishing that this was the method the quantity surveyor was expected to use in assessing the final building cost. Questions C4.4, A4.4, QS4.4 and E4.4 asked respondents to indicate the stage of the project that they would expect the quantity surveyor to implement intuition/judgement/ experience. Table 6.56 presents the results obtained.

Approximately a third (32%) of respondents expected the quantity surveyor to implement risk analysis using the intuition/judgement/experience technique at detail design stage (table 6.56). However, the clients (37%) said they expected their quantity surveyor to use this technique at tender stage, while about half of engineering firms (54%) said they would expect it to be used at sketch design stage.

Table 6.56 Stage at which QS applies judgement (Questions C4.4, A4.4, QS4.4, E4.4)

Stage	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Tender	22	11	8	5	46
Detail design	15	18	15	5	53
Sketch design	7	6	4	15	32
Feasibility	2	2	2	1	7
Inception	14	2	11	2	29
Total	60	39	40	28	167

6.5.2 Communication risk in the treatment of potential risks

In this section, the survey questions relating to communication risk in the practice and treatment of potential risk are examined, to establish the nature and extent of this risk in–the treatment of potential risks.

The respondents were asked about practices used in the communication of building risks. The examination of variables relating to communication risk was conducted in four sub-sections:

- data analysis of communication risk
- methods of risk communication used in estimates
- factors affecting cost planning service
- benefits to the client of a detailed cost plan used by the quantity surveyor in cost planning regarding.

The rationale for examining the first of these four parts was, firstly, that data must be analysed to separate cost-important risks from other less significant risks before they are communicated to the client and other members of the building team (engineers and architects). Therefore the researcher decided to begin with an analysis of communication risk.

The method used to communicate a risk to the client must be selectively chosen, to make sure that it can transmit the cost impact to the client (Loosemore, 1995)

Failures in the practice of project communication for planning purpose have been noted in the literature (e.g. Al-Momani, 1996) and some factors have been noted to affect cost planning service.

Therefore the researcher was keen to examine the factors that might cause communication risk in cost planning practices.

Based on the same reasoning, the researcher had to examine the data to find the nature and extent of the benefits to the client of a detailed cost plan incorporating risk assessment.

In order to establish the nature and extent of communication risk, the clients, architectural, quantity surveying and engineering firms were asked about their practices regarding communication used in building projects (see Questions C4.5, A4.5, QS4.6, E4.5, QS 2.10 to 2.13, QS4.5 and C2.5 to 2.8). The information gathered was selected and is presented in Tables 6.57 to 6.64.

6.5.2.1 Data analysis of communication risk

In this first sub-section of communication risk an overview is presented of the analysis of data regarding the nature and extent of communication risk in the provision of the planning process.

Physically separated disciplines and offices form barriers to the communication of project information which is so essential in building projects (see Loosemore, 1995). Each building project is managed under an ad hoc management structure that does not encourage the communication of project information between the disciplines and parties. For example, the sharing of project experiences and risk practices is not formulated in project setting (Edwards, 2001).

From the 28 variables suggested to the respondents, eleven significant communication variables were selected and are reported on in Tables 6.57 to 6.64. These eleven were selected because of their influence on cost planning – as was reported in the preliminary data analysis (see Appendix 3), which indicated them as significant to communication risk.

6.5.2.2 Methods of risk communication

In this second sub-section on communication risk, the methods used in communicating risk in cost planning are examined to establish the nature and extent of communication risk in building projects. Two types of communication techniques were selected for examination:

- reactive risk-communication methods
- proactive risk-communication methods.

These two techniques were chosen because they are suggested in the literature as often being absent from construction project organisation (Schumacher, 1996 and Loosemore, 1993). Questions C4.5, A4.5, QS4.6 and E4.5 asked respondents to indicate the communication method used by quantity surveyors in building projects.

6.5.2.3 Reactive communication

In this first part of the sub-section on methods of communicating risk, reactive communication of risk is examined, to establish its nature and extent in building projects. In a reactive communication method, drawing details are prepared after the project has begun. The budget prediction is expected to follow design (RIBA Plan of Work, 1980).

Table 6.57 Reactive communication of risk (Question C4.5, A4.5, QS4.6, E4.5)

Reactive risk communication	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Seldom	11	6	5	8	30
Occasionally	21	16	19	10	66
Always	20	19	16	14	69
Total	52	41	40	32	165

The researcher decided to examine reactive communication because current trends in the construction environment indicate that reactive communication has a great influence on the cost planning process (see preliminary analysis, Appendix 3). The results are reported in Table 6.57.

Table 6.57 shows that almost half (48%) of the quantity surveying firms reported that they only occasionally reactively communicate budget risk to the client. About half of the architectural and engineering firms indicated that they always communicate reactively.

These results imply that 82% of the respondents frequently communicated risk to the client reactively.

6.5.2.4 Proactive communication

This second part of the sub-section on risk communication examines the nature and extent of proactive communication in dealing with potential risk. Information on proactive communication was sought because early stage risk assessment needs proactive activity to manage and execute the process. Proactive communication helps the cost practitioner to set cost guidelines and targets for the project designer.

As already stated, questions C4.5, A4.5, QS4.6 and E4.5 had asked respondents to indicate the communication method used by quantity surveyors in building projects and Table 6.58 reports on the responses received.

Table 6.58 Proactive communication of risk (Question C4.5, A4.5, QS4.6, E4.5)

Proactive communication of risk	Number of respondent firms and organisations				Total
	Client	Architectural	QS	Engineering	
Seldom	12	8	5	7	32
Occasionally	23	18	19	9	69
Always	18	12	14	14	58
Total	53	38	38	30	159

Nearly half of the architectural, client and quantity surveying respondents indicated that they occasionally communicated risk proactively – i.e. before being requested by the client. Of the engineering firms, almost half (47%) said they always use proactive communication.

These results show that, by and large, building practitioners in Kenya have not yet appreciated the advantages of using proactive methods of communicating risk.

6.5.2.5 Factors influencing cost planning service

In this third sub-section of section 6.5.2, factors influencing the cost planning process are examined to determine the degree to which they influence the provision of cost planning and control. The respondents were requested to select, from a list of possible factors, those that determined whether or not they applied risk evaluation techniques in their cost planning. The three most frequently chosen were:

- risk evaluation not requested
- project size
- amount of design information available.

The examination was therefore divided into these three parts (see Appendix 3).

The 'not requested' factor has been noted in the literature (e.g. Miller and Lessard, 2001) as being critical in the provision of cost planning. For example, if the client is not aware of the cost planning service and had no intention of developing risk management strategies for a project then the quantity surveyor might not carry out risk evaluation unless a request were made by the client.

As regards the size of a project, the preliminary analysis indicated that respondents were of the opinion that this has a significant influence on cost planning. It is the physical characteristic that most influences whether or not a project will involve risks, as well as the type of risks to which the project might be exposed.

Finally, the amount of design information has been noted by Chapman (2001) to have a controlling influence on effective risk identification and assessment. Thus the researcher thought of the three factors as important variables for examination in the examination of the received data.

6.5.2.6 Risk evaluation was not requested

In this first part of the sub-section on factors influencing the provision of cost planning, the 'not requested' factor in the estimating process is examined to establish its influence on the provision of risk analysis in cost planning. Respondents were asked for their opinions on a list of factors that could influence whether or not the quantity surveyor applied risk evaluation techniques. The question was aimed at obtaining information on risk evaluation as the client might not be aware of the benefits of risk evaluation in cost planning. The researcher examined risk factors that influence risk evaluation in risk management and cost planning. The results of respondent opinions are reported in Table 6.59.

Table 6.59 Factors that influence application of risk evaluation (Question QS4.5)

'Not requested factor' influences risk evaluation	**Number of QS firms**
Seldom	7
Occasionally	10
Always	19
Total	36

Half (50%) of quantity surveying respondents reported that they did not apply risk evaluation techniques in cost planning because the service was not requested (Table 6.59).

6.5.2.7 Size of the project

This is the second part of the 'influencing factors' sub-section of Section 6.5.2 and it deals with the nature and extent of the influence that the size of a project has on the quantity surveyor's cost planning service. The size of a project was generally found to influence cost planning practices; for example Baker et al. (1999) report that project size is likely to indicate the scope of construction and is therefore important as an indicator of future risks in cost planning.

Table 6.60 Influence of project size on provided cost planning (Question QS2.10)

Size of project influences estimating method	Number of QS firms
Seldom	18
Occasionally	11
Always	6
Total	35

To establish the influence of the size of a project on the cost planning process, question QS2.10 requested opinions from quantity surveying respondents on their provision of a cost plan for the client. Table 6.60 records the results obtained.

Half of the quantity surveyor respondents (51%) reported that the size of the project seldom influenced their provision of cost planning advice. Indeed, 83% of quantity surveying firms reported it as being influenced at most occasionally.

6.5.2.8 Information available

In this third part of the Sub-section, the 'amount of information available' factor is examined. Question QS2.13 was aimed at establishing alternative factors that influence budget accuracy in the cost planning process. It is evident from the studies done in Jordan (Al-Momani, 1996) and Indonesia (Kaming et al., 1997) that the cost consultant needed more information to make an informed decision on cost plan and budget prediction. Al-Momani (1996) and Brandon and Newton (1986) noted that better understanding of unpredictable factors and future costs would enhance cost planning and control. The practices of quantity surveyors were therefore sought from respondents, who were asked to choose from a list of possible factors such as estimating expertise, amount of information available and the method used in estimating. The amount of design information available was indicated as having a greater influence on cost planning than other factors. The results are presented in Table 6.61.

Table 6.61 Influence of the information available (Question QS2.13)

Amount of information influences estimate produced	Number of QS firms
Occasionally	0
Always	40
Total	40

It can be seen from Table 6.61 that respondents' were of the unanimous opinion that the accuracy of an estimate always depended on the amount of information available.

The results given in Table 6.61 imply that lack of information is a cause of inaccuracy in estimates.

6.5.2.9 Benefits to the client of a detailed cost plan

In this final sub-section of Section 6.5.2, the nature and extent of the client benefits derived from a detailed cost plan are examined to determine the degree to which the provision of cost planning that benefit the client. The perceptions of clients towards committing more resources for quality services offered by the quantity surveyor vary from project to project and therefore it was important to the researcher to examine the data relating to the benefits obtained by the client from a detailed cost plan.

To establish quality practice and its benefits the examination was conducted in three sub-sections:

- client awareness of cost planning
- influence of detailed budget in preventing abortive work
- influence of detailed budget in preventing cost overrun.

The rationale for choosing the first of these three parts was that before a project begins the client needs to be aware of the existence of the quantity surveyor's services and understand what it means.

The researcher chose to examine the influence of detailed budget in preventing abortive work and cost overruns because of the significance they were accorded by client respondents in answering question C4.6 (see Appendix 3).

6.5.2.10 Cost planning awareness

In this first part of the 'client benefits' sub-section, client awareness of the practice of planning and control is examined to establish the nature and extent of the communication provided by the quantity surveyor.

Table 6.62 Cost Planning and Control service and client cost planning awareness (Question C2.8).

Client awareness of Cost planning and control concept and practice	Number of client organisations
No	7
Yes	53
Total	60

In question C2.8 client respondents were asked to select practices that related to their cost planning. Table 6.62 records their responses.

The majority of the client respondents (88%) were aware of the concept of cost planning and control and its practice.

6.5.2.11 Budget influence in preventing abortive work

In the second and third parts of this sub-section, some benefits of having a detailed budget are examined. This detailed budget cannot be produced without adequate data, which is produced only at later stages of the project.

Table 6.63 Detailed budget and abortive work (Question C4.6)

Influence of detailed budget in preventing abortive work	Number of client organisations
Not influential	8
Influential	20
Vitally influential	32
Total	60

In one part of Question C4.6 (see Appendix 3), client respondents were asked to indicate how influential a detailed budget was in preventing abortive work in building projects. The results are recorded in Table 6.63.

The majority of client respondents (52%) reported that the detailed budget was vitally influential in preventing abortive work risk and only 13% said that it was not influential (Table 6.63).

6.5.2.12 Budget influence in preventing cost overrun

As mentioned above, in this third part of the 'client benefits' sub-section, another benefit of a detailed budget is examined. In another part of Question C4.6 (see Appendix 3), client respondents were asked to indicate how influential a detailed budget was in preventing cost overrun. It should be noted however that cost overrun might not be prevented, even by a detailed budget, if incomplete or insufficient information is provided. The results of Question C4.6 are reported in Table 6.63.

Table 6.64 Detailed budget and cost overrun risk (Question C4.6)

Influence of detailed budget in preventing cost overrun	**Number of client organisations**
Not influential	10
Influential	27
Very influential	25
Total	62

The majority (84%) of the client respondents reported that a detailed budget was influential in preventing cost overrun risk (Table 6.64).

The implication of the results shown in Table 6.64 was that a detailed budget does assist in the prevention of cost overruns.

6.5.3 Summary of risk management practice and the treatment of potential risks in cost planning and control

This section presents a summary of the findings relating to risk management practice and the treatment of potential risks in cost planning and control.

- *Client organisations (65%), quantity surveying (64%) and architectural (55%) firms were found to be familiar with the theory of risk management. However quantity surveying (52%) respondents and engineering (100%) respondents reported that they were not experienced in practice of risk management.*

- *The majority of quantity surveying respondents (83%) said they always used the approximate quantities method to provide an estimate of the final building cost.*

- *The majority of respondents (65%) used the 'intuition, judgement and experience' technique to assess the risk component of a final building cost.*

- *Almost half (47%) of the quantity surveying firms occasionally used reactive communication to indicate the extent of risk in the cost budget. Nearly half of the architectural firms said that they occasionally communicated risk proactively to the client, only forty percent of the client respondents reported that building risk was communicated to them proactively.*

- *According to the quantity surveying firms reviewed, the accuracy of their estimates always depended on the amount of information available, and that the size of a project seldom influenced the provision of cost planning advice.*

- *The detailed budget was influential in preventing both abortive work and cost overruns.*

- *There appears to be room for an improved communication risk assessment to enable further improvement on budget prediction and risk management. Additional insights were needed regarding assessment and communication risk in building budget prediction; this will be discussed in Chapter 8.*

6.6 Substantive issues of cost planning arising from the questionnaire data analysis

An examination and interpretation of the data collected in the questionnaire survey has been provided, to establish the nature and extent of the cost planning process. A summary is now presented of some issues in the practice of cost planning and risk management, to supplement those survey results which require further clarification.

In this section, substantive issues arising in this chapter from the data analysis and its interpretation are introduced. This is for two reasons. Firstly, a detailed inquiry into the issues raised by the questionnaire is essential, supplementing the reported responses with a more detailed discussion on the issue of cost planning and risk management. Secondly, further investigation with the questionnaire method was not possible due to the nature of postal surveys. These issues will be discussed in more detail in Chapters 7 and 8.

In an attempt to supplement the survey results, the researcher decided that the issues of cost planning and risk management were suitable material for case study interviews. The selection of these two issues for further investigation rose from the data analysis and interpretation of the questionnaire survey.

Ten issues of cost planning and risk management were selected from the questionnaire responses. A detailed data protocol for the data collection is discussed in Chapter 7 and case study reports are presented and summarised in Chapter 8.

For the case study, questions focusing on issues arising from the data analysis and interpretation of the questionnaire survey were formulated, to offer guidelines in the forthcoming discussions with informants.

The ten questions were composed, centred on the following issues:

- The nature of risk experience
- The accuracy of cost advice
- Assessment potentials of the building budget
- The implementation of information / data in risk analysis
- Cost impacts on budget prediction
- Frequency of financial risk occurrence
- The typical response to financial risk impacts
- Quantifying risk and risk management in building budgets
- Communication problems related to likely cost impacts
- Practice issues raised in budget assessment (i.e. estimation problems faced by the estimator).

The rationale for deciding to raise questions based on issues from the questionnaire survey that needed to be clarified was that each issue raised in an interview would provide the researcher and the respondent with a chance to discuss the original survey responses. By going back to the respondents who had supplied the original opinions, the researcher would, hopefully, be confirming his interpretation and identifying the most important risk indicators in current practice.

Details of the case study discussion and the criteria used for project selection, as well as questions for the case study interviews, are presented in Chapter 7.

6.7 Discussion of the questionnaire opinion survey data and its interpretation

In construction projects, clients are frequently exposed to financial risk as a result of the final building cost exceeding the budget. The argument of this research is that the risk management function exercised by the quantity surveyor in cost planning and control of building projects in Kenya is ineffective. A questionnaire opinion survey was the method chosen by the researcher to confirm this proposition, and the case study interview will be used to supplement the survey on issues that rose from the data analysis.

In this section a discussion of the results from the data analysis and an interpretation of the questionnaire survey is presented, to establish whether the objectives set out in Chapter 1 have been satisfied. An attempt has been made in this chapter to establish the nature and extent of risk management in the cost planning and control offered by the quantity surveyor, and this section summaries the important points raised by the analysis and interpretation.

The cost planning services offered and provided by the quantity surveyor in building projects has been firmly established in the researcher's data analysis and interpretation, and it was noted that the bills of quantities method was the preferred cost planning instrument (Table 6.20). However, depending on the stage of building construction, approximate quantities were also extensively used for assessing the final building cost and for other cost planning purposes.

The amount of project information available for estimating cost plans (Table 6.61) was unanimously believed to influence the accuracy of the estimate of final cost. Risk management and cost plans (budgets) prediction should be used together to enhance estimated cost planning as they are part and parcel of quantity surveying services. The ability of the quantity surveyor to predict cost plans (building budgets) was found to be critical due to a lack of adequate project information at the early project stages. It is understandable therefore that quantity surveyors resort to the familiar presentation of information, such the one used to in the bills of quantities, when called upon to forecast or estimate a building cost (see Brandon and Newton, 1986).

The questionnaire opinion survey found that the detailed bills of quantities method was extensively used in the provision of estimates (see tables 6.30 and 6.31). Use of bills of quantities to produce a detailed cost plan causes financial risk to the client, as there is lack of project information to support an early detailed budget prediction at project inception (see Tables 6.9 and 6.11).

The study found that the use of intuition/judgement/experience to support budget prediction with use of the bills of quantities method was affected by inadequate pricing data, incomplete design, and a lack of project information (see Table 6.54 on the preferred risk analysis method, and Table 6.61). In the risk management literature (e.g. Mok et al., 1997), formal risk analysis techniques, which might enhance cost plans and incorporate risks in cost planning and control, were seldom used in cost planning. In this study respondents reported that they were familiar with risk management theory (see Table 6.49) but said that they did not have much experience in the practice of risk management (see Table 6.50) - an apparent contradiction.

Regarding risk management theory, the study found that respondents could identify eight risk factors and sources significant to cost impacts on financial risk management and budget prediction (see the examination of data in Section 6.4.1 on cost impact risk). The risk factors and sources identified were the size and the complexity of the project, quality of design information, design variation, progress payment valuation, political uncertainty, experience of the estimator, interest rate changes and market conditions (see Tables 6.37 to 6.48).

It appears that experience in the practice of risk management is lacking among Kenyan quantity surveyors, and the use of grouped risk indicators to represent similarities has by and large not been utilised in risk management (see also Kendall, 1980). Clustering the assessment and evaluation risks, and later quantifying them with the established risk knowledge and experience, would greatly simplify risk management (Samid, 1996).

The probability of occurrence of clusters of risk in a project could be determined by using the current level of cost practices and thus establish a better understanding of building risk. It appears in the study that there is significant room for improvement of risk management in the cost planning and control of building projects. The opinion of the researcher is that clustering and grouping of risks into compound risks would improve the assessment of building risks and their management (see Table 6.55 on using the preferred method in probability analysis).

Dealing with risk clusters and groups would enable the quantity surveyor to form compound risks which would turn the unknown risks into a management problem, where all building risks would be incorporated into an estimated cost plan. Compound risks so formed can then be assessed by using intuition/judgement/experience to support cost assessment, and probability analysis to establish the frequency of occurrence risk for each of the risks (see Tables 6.54 and 6.55 on risk assessment in the treatment of potential risk).

Respondents' opinions on financial risks and budget prediction varied but Sections 6.2 to 6.5 examined the findings from the analysis of the data in terms of six research themes. These themes were based on risk issues regarding current practices, and attempted to achieve the research objectives of facilitating better understanding of risk management in the cost planning and control of building projects, and hence to address the research problem. Sections 6.2 to 6.5 provided a basis for testing ideas generated by the risk variables, to determine whether the discussion on the data analysis satisfies the research objectives stated in Chapter 1.

These research objectives are now recapitulated and discussed.

6.7.1 Objective One

To identify the current practice of cost planning and control of building projects employed by professional building cost consultant firms in Kenya.

Respondent opinions on the measurement and quantification of project information were examined (see Questions C1.7–2.5, A1.6–2.5, E1.6–E2.5 and QS1.6–2.6), with the aim of identifying current cost management practice in building projects. Questions C2.5, A2.5, E2.5 and QS2.6 sought opinions on current cost planning and control practices, and Questions C2.8, A2.8 and E2.8 checked whether cost planning and control services were offered to the client.

The objective was satisfied by the data analysis, which exposed four cost-significant practices of cost planning and control: setting out cost limits; use of elemental cost planning; checking cost plans at tender stage, and use of approximate quantities as the basis of risk assessment.

Current practice shows extensive use of bills of quantities in cost planning and control (see Tables 6.30 to 6.33). The principal question asked for information regarding the preferred estimating method and its potential in assessing various forms of risk allowances (see Questions QS2.2 and QS2.4; checked by C4.2, A4.2, QS4.2 and E4.2).

The study found that, to guide project development, first cost advice needs to be given in some detail, and thus led to the use of itemised bills of quantities. Further findings are now given.

Bills of quantities method of estimating was the preferred contract documentation and estimating method.

Approximate quantities were used to assess the final cost of a project, but the preferred bills of quantities method was not.

Extensive use of bills of quantities raises two questions regarding current practice. Firstly, should it be prepared in advance for the cost planning and control of building projects, and secondly, could the cost consultant produce reliable bills of quantities at the early stage of building development when little information is available?

The conclusions drawn from the literature (e.g. Bowen, 1993; Brandon and Newton, 1986) and from current practices showed that the use of the approximate quantities method was a significant risk indicator in the assessment of the final cost plan. Besides that, it was documented in Tables 6.30 and 6.31 that bills of quantities was the preferred method of contract documentation.

A lack of adequate project information made the use of the approximate quantities method attractive to the estimator (quantity surveyor) because the units of measurement used in approximate quantities are simple to derive and practitioners are able to link their experience to the costing of estimating items (ibid.). Thus the approximate quantities method has been the preferred method in assessing risk allowances in building projects (Table 6.51). Increasing the amount of information available at early stages of the project would make it possible for a detailed cost plan to be produced early enough to guide project development.

6.7.2. Objective Two

To identify the risk characteristics of construction projects and the risk management techniques employed by professional building cost consultants in the cost planning and control of building projects.

For this objective, relevant questions are 3.1–3.3 for all four groups (A, C, E and QS).

This objective was satisfied through the identification of sources of risk. These included lack of experience in large-scale projects (83%), late appointment of the cost consultant, quantity surveyor's late cost advice at tender stage (36%), and receipt of detailed budget information only at detail design stage (46%). Risk characteristics were also identified, for example, lack of experience on the part of the cost estimator, risk assessment, risk quantification and lack of information risks in building projects.

In addition, the risk characteristics could be shown by four risk sources that were reported to have cost impact on the building cost plans. These were consultant experiences (25%), size of project (21%), complexity of project (18%) and market and tender conditions (16%). Completeness of design (20%) and political uncertainty (11%) were major contributors to building risk, and should be responded to with appropriate cost increases, assessed for incorporation into the final building cost.

It appears that compound risks, risk avoidance and an attempt to reduce risk exposures in risk management made up an effective risk management strategy that could be used to assess and control risk impacts on cost plans.

The risk management technique used to assess a project and employed by most quantity surveyors was intuition/judgement/experience (63%). The results from the data analysis and interpretation of cost planning and control of building projects showed a trend of attempting to avoid or at least reduce impacts in cost planning.

This study showed evidence of risk avoidance, and exposure reduction was the preferred technique of risk management employed in the planning process.

6.7.3. Objective Three

To evaluate the efficiency of traditional cost planning procedures with special reference to adequate identification of their sources, thus enabling a positive response to the adverse risk conditions that create construction cost excesses and cause final construction costs to exceed defined budgets.

Adverse events should be identified at source thereby enabling a response to be initiated. Client, architectural, quantity surveying and engineering firms' opinions were sought (see Questions C2.7–2.12, A2.7–2.12, E2.7–2.12 and QS2.8) on their knowledge and experience with regard to the practice of traditional cost planning and control in Kenya.

The objective was satisfied by the results obtained from the accuracy theme (see Section 6.3.3). The accuracy data analysis shows that received estimates are expected to be within 5% accuracy at post tender stage (see Tables 6.30 to 6.34) but early budget calculations will have a high inaccuracy allowance which might expose the client to budget errors (see Table 6.31). Traditional estimating methods are inadequate in addressing risk assessment and have low potential for attaining accurate budgets. Table 6.31 shows that 55% of quantity surveying respondents considered that the bills of quantities method had the potential to assess risk allowances to within 5% of the final building cost. The findings from this research corroborate Mok et al. (1997) and Fitzgerald and Akintoye (1995) on the inadequacy of traditional estimating methods. The bills of quantities method was perceived to possess the highest potential to assess risk in building projects.

Thirty-four per cent of respondents indicated the inefficiency of traditional cost planning and control procedures in assessing building risks, as reported in Table 6.32 on the accuracy of expected estimates. One fifth (22%) reported that accuracy levels of estimates received from the quantity surveyor at project inception were above 30% relative to the accepted tender (Table 6.34). The majority of respondents (76%) reported that the bills of quantities method had good potential to incorporate risk allowances (see Table 6.31). All the quantity surveying firms supported the use of bills of quantities, indicating that they have good potential to incorporate risk allowances (Table 6.30).

Traditional estimating methods cannot always adequately identify sources of risk, as project problems are most often communicated reactively (see Table 6.57), and these methods do not allow for quick responses to adverse risk conditions. Checking of the cost plan against the estimate is only implemented at tender stage creating chances of cost excess (see Tables 6.15 to 6.17). Inadequate project information and late quantity surveyor cost advice received at detail design stage (see Tables 6.21 to 6.23) might cause final construction costs to exceed defined predetermined budgets. Late quantity surveyor cost advice derived from traditional estimating methods might not help in assessing anticipated risks that cause cost overruns (see Table 6.64).

6.7.4 Objective Four

To examine the benefits that could be derived from a properly formulated risk management system within the context of the cost planning and control of construction projects.

Respondent opinions were sought (see, for example, Questions QS2.2–2.5, C4.1–4.4, A4.1–4.4, E4.1–4.4 and QS4.1–4.4) regarding the type of cost information they had used in their current projects. In addition, Question C4.6 sought information on the influence of a detailed budget in preventing financial risks.

This objective was achieved by using the questionnaire, which showed that it is beneficial to appoint the cost consultant early in project development, and to avoid the use of detailed bills of quantities as the basis of contract documentation and cost assessment. The use of approximate quantities – an innovative but simple approach to "rough" risk quantification – could solve the problem of budget cost assessment.

The vast majority of the client respondents reported that a detailed budget is influential in preventing abortive work (see Table 6.63), and 43 per cents believed that it could help prevent cost overrun (see Table 6.64).

The general opinion of researchers (e.g. Drury, 1992) is that the building team should all participate in budget prediction, guided by the quantity surveyor and should provide timely and early designs in order for cost planning to be completed during the early project stages. In addition, market conditions should be investigated and ascertained for anticipated changes to be allowed for in estimated cost plans. The design variation should be resisted after a budget has been agreed upon between the team members and, in the opinion of the researcher, beyond the detail design stage no further design variation should be considered for inclusion into the design as this would affect the agreed estimated cost plan.

Budgets should incorporate all likely design variations. For example, political uncertainties, incomplete design details and expected errors in bills of quantities should be anticipated and either avoided or reduced as part of risk management strategy in the budget prediction.

6.7.5 Objective Five

To develop recommendations for changing cost planning and control procedures, so as to accommodate the risk management function in the cost planning and control of building projects. This should facilitate timely identification of, and response to, potential budget overruns.

The perception of respondents regarding the accuracy of building cost plans in various forms of buildings were sought (see, for example, Questions QS2.12, C2.11 and 2.12, A2.11 and 2.12, E2.11 and 2.12) at different project development stages, as well as respondents' opinions (see Questions QS2.2 and 2.4, C4.2–4.4, A4.2–4.4, E4.2–4.4, QS4.2 and 4.4) on risk assessment in their current projects. The respondents identified those responses in their current projects which they thought would affect the project's final estimated cost (see Questions C2.5–2.8, QS 2.10–2.13, C3.3, A3.3, QS3.3, E3.3, C4.5, A4.5, E4.5, QS4.5 and QS4.6).

This objective was satisfied by identifying those risks in building projects which need to be incorporated into cost planning and control procedures, as the client requires a accurate as possible a picture of the future budget. The observations from the data analysis and the literature, for example, Edwards (2001) and Loosemore (1995) showed that communication of project information and problems was proactive rather than reactive.

The researcher's recommendations sought ways of improving the quality of the bills of quantities method in budget prediction and subsequent improvement of the intuition/ judgement/experience technique of risk analysis. Further details on these recommendations are presented in Chapter 10.

6.7.6 Integration of risk management into the cost planning and control procedure during the cost prediction process

Converting drawings into measurements and subsequently quantifying risk was important in the cost planning and control services offered by the quantity surveyor.

Respondent opinions on the measurement and quantification of project information were surveyed (e.g. see Questions C2.5, A2.5, QS2.6 and E2.5) and the results showed that the majority (78%) of the respondents indicated that there should be control of building costs at the early project development stages (see Table 6.26). Furthermore, the majority (64%) of quantity surveying firms reported that they set up cost controls for their projects. One fifth (20%) of the respondents indicated that there was no need to set up cost control measures (see Tables 6.26 and 6.27).

The observations from the analysed data indicated that there was little integration between the two bodies of knowledge of risk management and cost planning and control. The majority (86%) of respondents confirmed that the practice of setting cost limits existed within the Kenya building sector (see Table 6.27). Setting cost limits was an inappropriate method of financial planning due to project designers' disagreement with financial controls (Pender, 2001) and because changes to design were likely to occur as the building was developed.

Respondents indicated that the services of risk management, cost planning and cost control were not seen as essential at early project stages. Nearly half the respondents (49%) indicated, however, that a cost estimate was 'vitally important' at detail design stage (Table 6.24). The client respondents did not consider the cost plan an important risk management tool and this concurs with the research findings of Edwards (2001) and Songer et al. (1997). Tables 6.24 and 6.25 in Section 6.3.2 showed that there was little integration of risk management into cost planning and control procedures.

The majority of quantity surveying respondents (83%) indicated that they always used the approximate quantities method to provide an estimate of the final building cost (see Table 6.51). The bills of quantities method and the assessment risk are prepared in isolation of each other. Quantifying risk approaches was not integrated into bills of quantities although implementation of the approximate quantities method in forecasting the cost was the preferred method of quantifying and assessing building risk. Table 6.20 shows the preference for use of bills of quantities in project documentation in the contract procurement process for building works. A quarter of the respondents always used bills of quantities as the basis for project documentation in the contract. Client organisations and quantity surveying firms (37% and 65%, respectively) used bills of quantities in at least 90% of project contract procurement cases, but still cost planning and control and risk management services are offered separately.

Three questions were put to the respondents on issues concerning cost assessment and risk analysis techniques which allow incorporation of risk into cost planning and control. The majority of clients (65%), quantity surveying (64%) and architectural (55%) firms were familiar with the theory of risk management but half of quantity surveying respondents (52%) and 100% of engineering respondents reported that they were not experienced in the practice of risk management (Tables 6.49 and 6.50).

Intuition, judgement and experience was the only risk analysis technique used by the majority of (65%) respondents, and client, engineering and architectural firms always expect the project quantity surveyor to use this method for assessing the risk of the final building cost (Table 6.54). The use of the bills of quantities method in estimating cost plans, as done in traditional estimating practices, had to be improved (Al-Monani, 1996). At the same time, 52% of quantity surveying respondents indicated that they did not use risk analysis techniques. The majority (65%) of client respondents indicated that they were familiar with the practice of risk management.

Quantity surveyor respondents said that they did not provide risk management services because they were not familiar with risk management applications. Cost planning and control was seldom or never requested unless offered as part of the quantity surveying services (see Table 6.59). The use of the comparative cost planning method implies production of several design alternatives for discussion with the design team. Table 6.29 shows that the engineering and architectural firms seemed to agree with the use of this method in the cost planning process but there was little difference in opinion between the two methods of cost planning, showing a possible lack of familiarity and experience in the application of the comparative method. Lack of experience in the application of comparative cost planning showed that drawings were not produced in advance so that they could be discussed before cost plans were prepared. The two services were not integrated during risk management in cost planning and control practices.

The quantity surveying firms indicated that the quantity surveyor approaches cost planning and control separately from financial risk management. Budget prediction in building projects involves the two disciplines of risk management and cost planning and control but, when treated separately, the risk management functions in cost planning and control of building projects proved ineffective.

6.8 Conclusions

This chapter has documented the analysis of the opinion survey and the interpretation of the responses obtained. Comparison of the results and discussions within the context of the literature are discussed in Chapter 9.

- *Current trends and experience in risk management and cost planning practice were identified in the study, and these have been used to provide indicators of current practices in cost planning, cost control risk management and the treatment of potential risks.*

- *The observation of current practices has identified three cost-significant risk indictors, namely, use of the bills of quantities method, complexity of the project and size of the project.*

- *It was shown that the quality of bill quantification has a significant effect on budget prediction. Bills of quantities is the mode of quantification and cost assessment of risk allowances preferred by the majority of building cost practitioners.*

- *The physical complexity and the physical size of the project are significant risk indicators. Other risk indicators likely to impact heavily on the cost plan are design completeness, market and tender conditions, and consultant experience.*

- *The risk management technique employed by the professional building cost consultant appears to rely on avoidance and reduction of cost impacts, particularly as regards the physical size and complexity of the project.*

The implications of the findings are that:

- *The absence of risk quantification in traditional cost planning procedures contributed towards ineffective risk assessment.*
- *Informal quantitative risk analysis limited the capacity of the quantity surveyor to assess all risks.*
- *Poor quality information increased the ineffectiveness of predicted budgets.*
- *There was an insufficient allocation of time to investigate all possible risks.*
- *The briefing process is generally poor and fails to focus on future building states and events that might impact on cost.*
- *Cost prediction relies on historical data and the previous cost impact which might not be appropriate to the future budget situation or the occurrence of future risk and cost trends.*
- *The uncooperative nature of certain people in ad hoc management structures sometimes hindered cost participation, thereby contributing to ineffective risk event communication.*
- *There was no evidence of risk investigations by the quantity surveyor into future cost trends.*

The current practices raised cost assessment issues that could not be clarified by the questionnaire instrument alone. Further clarification by case study interview was required to supplement data collection, and this is presented in Chapter 7. The case study analysis in Chapter 8 supplements the questionnaire survey results, and is discussed in Chapter 9, where the researcher's conclusions are given in some detail. The implication of the research and conclusions are used to recommend changes to risk management in cost planning and control procedures. These are given in Chapter 10.

CHAPTER 7

Case Study Protocol

7.1 Introduction

A summary of the adopted case study interview research design is given below. The research objective was to gain a live but impartial observation of the project costing and risk-management history of five different projects, by interviewing five different professionals.

This chapter reports on the case-based study protocol used in investigating significant issues which could not be clarified by the postal questionnaire survey. It deals with the case study protocol in five parts, namely:

- the issues investigated
- justification of the case study approach
- the development of the case-based research protocol
- the composition of the case reports
- conclusions.

The first two of these five parts were chosen because issues requiring clarification have to be stated explicitly so that a justification can be made for using a case study to supplement the questionnaire survey. Further, some issues raised in the survey could not be investigated further using a postal survey method and the development of case interview method was therefore necessary.

7.2 Issues investigated in the case study

In order to establish the nature and extent of the cost planning and risk management offered by the quantity surveyor, this section presents an introduction to the issues requiring further investigation that arose from questionnaire survey.

Questionnaires provide an appropriate instrument for probing the budget environment where company information is considered as being confidential. It is a good method for gathering general information that is not focused on specific projects. Unfortunately, it provides the researcher with little control over the events being investigated or any opportunity to inquire further about issues as they arise. In contrast, a case study allows inductive logic reasoning to be used in gathering information, to move from general to more specific terms.

When seeking a holistic understanding of an event or a particular situation, a case study gives the researcher the opportunity to obtain meaningful insights and important information on certain events that can not be revealed without personal interaction and trust. The value of human experience and interaction can be utilised in case studies, so case-based research was used in identifying important factors that influence risk management in cost planning and control. The identified significant variables were tested against facts from established theory and findings from the opinion survey. In the case study interviews, respondents' opinions were sent back to the field for discussion and confirmation, resulting in important insights emerging as research findings. Such a process improved the researcher's understanding of risks and their management in cost planning and control.

7.2.1 Case study issues

In this section the issues dealing with the practice of cost planning and risk management are presented, to establish, in specific case studies, the nature and extent of the services offered by the quantity surveyor.

Variables that influence current risk management of cost planning and control practices were selected from the literature survey and formed the basis of the opinion survey. Important variables for further clarification from the respondents were then identified. In the case study interviews these variables were tested against opinions held by project cost advisers. Feedback from the case study respondents was also used to clarify selected issues, since the questionnaire investigation did not always give sufficient detail; for example, it could not allow checking of rival or conflicting opinions.

In an attempt to establish the nature and extent of the practice of cost planning and risk management offered by the quantity surveyor, ten issues from the questionnaire survey were chosen as indicators of areas that needed further clarification. These were:

- The nature of price data
- The accuracy of cost advice
- Potentials to assess budget costs
- The implementation of risk analysis techniques

- Cost impacts on the budget
- The frequency of financial risk occurrence
- Typical responses to financial risk
- Risk management in building budgets
- The communication of likely cost impacts
- Current problems of estimating cost plans

The rationale for selecting these ten issues was that they would supplement information for the researcher. It was hoped that the results obtained would help the researcher arrive at conclusions on the type of risk indicators that should be used to improve risk management in cost planning and control.

7.3 Justification of the case study approach

The theoretical understanding of risk and risk management explored in Chapter 2 was followed up in Chapter 3 with a discussion of risk exposures arising from traditional cost-planning procedures. The effects of risk impacts and their implications on the building budget environment were then discussed in Chapter 4 and the postal questionnaire survey design was justified and developed in Chapter 5.

Chapter 1 and Chapter 2 – the literature survey – laid the foundation for choosing significant risk variables affecting risk management in cost planning, which could be tested in the current practices. The questionnaire survey with the subsequent descriptive statistical analyses, was able to deal with situations where projects and their building teams were heterogeneous and routine, enabling the researcher to gain insights into factors affecting risk management in cost planning and control in a heterogeneous budget environment.

Direct risk experiences are required to yield clear detailed information and these could not be obtained from a questionnaire survey. The questionnaire survey provided identification of current practices and representative opinions of the diverse building industry respondents but lacked information regarding specific explanations of project and homogeneous[11] budget environments.

The literature review showed little evidence of benefits that could be derived from general cost data and indicated that detailed cost data could not be expounded upon without an investigation of specific projects in real-life project situations. A questionnaire opinion survey produces information

[11] Dealing with only one professional group.

that is not specific to any particular project, since each project is unique, so information gathered in one project cannot necessarily be generalised to others. However, a case-based real-life case study is suited to such an investigation, as it would produce more detailed cost plans than could be made available through opinion questionnaire survey and statistical analysis.

Reference to abstract information, without introducing specific inputs into projects and events of future cost outcomes, has not advanced cost knowledge or explained the benefits to be reaped from a properly formulated risk management system, which could be gained from field experiences. Certainly, project-specific information and proactive cost inputs call for a case-based research cost investigation and a more detailed, rich, project-specific data was thus required.

A case study interview enables the researcher to focus direct attention on live budgets in real projects that cannot be addressed through opinion survey-based research design. In a case-based research design the researcher is provided with the opportunity of observing the budget environment at first hand, without having any influence on the particular project. Hence 'how?' and 'why?' questions in effective budget prediction were introduced in the case study to cover the lack of specific and detailed information in a homogeneous budget environment. Information about real-life budget environments could be obtained from case-based research that investigated selected homogeneous projects.

A high quality case study involves interaction between theoretical issues being studied and the data being collected (Yin, 1994). Whilst a case study presents an opportunity to the researcher to take advantage of meeting the informants it also presents an opportunity to discuss unexpected events in the primary research tool. Using sufficient precaution against biased procedures the researcher can check the results of an earlier survey with the respondents.

The capacity to generalise findings in a case study has been criticised (Edwards, 20001 and Babbie, 1995), and the researcher agreed that homogeneous management information could not be adequately representative to incorporate the greater population. In such a non-repetitive environment, external validity is difficult to achieve. However, case study findings are specific, applying to one project alone so, since only a limited number of events recur, focused and detailed investigation from them will be useful in only a few cases (Edwards, 2001).

7.4 Developing the case-based research

This section discusses the development of the case study research, to establish the nature and extent of the supplementary information required from respondents. The research was conducted in seven sections, namely:

- the goals of the case study
- selecting the cases studies
- the selection criteria
- selecting the appropriate method for collecting data
- the use of non-participant observation
- the use of the interview approach
- the case study interview design.

The rationale for the first of these seven sections was that the goals of the investigation had to be established before details of issues could be raised. The method used in collecting the supplementary information has to be set out in advance so that only quality information is gathered, leaving out non-essential details. The use of an observation method was essential for the informant to provide information without the interference of a researcher-observer. The informant will agree to an interview format only if he or she trusts the researcher. This happens most readily in the interviewee's 'natural setting' – where they feel comfortable – for instance in their own office as opposed to in the researcher's room or even on site at a job. In fact, all three of these venues were used at different stages.

7.4.1 Goals of the case study

The study sought to illuminate participants' experiences in the context of information prediction and it involved assessing knowledge and case experience, based on the idea that the quantity surveyor should shift away from passive absorption of cost information to more active budget prediction.

The case studies protocol entailed the recalling of the history of the budget information cost assessment carried out at the early development stages, as well as innovations used in cost prediction. In such situations, insights into creativity and innovation in solving risk problems in case budget prediction are obtained for use in other cost assessments in building projects.

Project-based cost managers generate their own risk analysis techniques for budget prediction, developing case-specific solutions rather than formally applying their knowledge and experience to future projects.

7.4.2 Selecting the cases studies

Five case study interviews were undertaken, using a consistent and repeatable methodology. These were made up of open questions (see Case Study Format Table in Appendix 1), since it was possible to make a number of reliable generalisations based on information gained from the literature survey after this had been confirmed by the questionnaire (Yin, 1994).

The structured nature of the questionnaire survey invited the inclusion of other factors into the supplementary case study. Open questions were used to give the informants a wholly undirected, not pre-determined, instrument. The use of open questions was also aimed at offering some measure of confidence in answering without reference to recorded details (Atkinson, 1998). The case study approach attempted to provide the informant with an open discussion, with the researcher guiding and directing the discussion. The informants were free to answer the questions in their own style by adding details where possible.

7.4.3 Selection criteria

In this section, the nature and extent of the case study selection is discussed. The study gave the researcher and the respondents an opportunity to discuss cost planning in projects.

Respondents were approached to see if they would welcome the opportunity to discuss their projects. Appointments were then made with willing respondents. Five case studies were selected after meeting the selection criteria: the respondents chosen had to be part of a registered firm of consultants and have adequate experience in managing building costs and the project's estimating functions. Case documentation was expected to support the facts of the project narrative. All five projects chosen were accessible and involved important cost planning and risk management issues relating to budget prediction.

The case studies were also selected on the basis of the size, complexity and currency of the project involved, as well as the availability of information on the project, and the participant's willingness to communicate that information. The projects investigated were stratified by professional discipline, although was there no order of selection.

Edwards (2001) and Yin (1994) suggested that more than one case is necessary in order to obtain adequate data on which to generalise gathered information whereas increasing data validity. In this way there would be variations of data received from the various selected cases which could be later ending being generalized. Consequently five homogeneous groups of research participants were selected that could provide representative information of the various building projects.

Table 7.1 Case study interviews: list of required information

Project descriptive requirements:	**Risk indicator**
Type of project	
Type of client: Client / Project	
Budgeted sum	
Estimated final cost	
Contract sum	
Contract period :	
Level of design variation indicators	
Level of financial risk and communication indicators	
Project budget prediction problem and limitation indicators: Financial risk indicators	
Cost Management Experience	

Table 7.1 lists the background information sought from respondents who were willing to participate in the case study. It was this information that was used to choose the final five interviewees. It shows that researcher flexibility regarding the descriptive requirements was important in terms of the details sought, while the project information and risk indicator were required to solve issues raised in the research (Edwards, 2001). The researcher had to build explanations based on the case histories so that the interview questions would guide the flow of the discussions.

Having considered many options, flexible open questions were chosen, which provided cost details to investigate the knowledge inputs of the respondents. The semi-structured question framework ensured that risk management and cost planning issues in cost prediction were not overlooked. The informants' offices were chosen as the place for the interviews, to minimise distractions.

The interview focus was on cost prediction and management practices rather than on different financial risk strategies or techniques. So in each case study there was a different interview setting and an interpersonal interaction was thus possible, creating trust between the researcher and the willing participant.

7.4.4 Selecting the cases and informants

In this section the justification for selecting different interview informants ranging from the quantity surveying firm to the appointed resident engineering firm is presented, to facilitate understanding the results analysed in Chapter 8.

The section attempts to justify the use of different professions and their firms for gathering information in the case study interviews. This approach was aimed at establishing the nature and extent of construction project cost planning and control, in five individual cases. The rationale for this approach was that a case study is generally a story that presents the detailed narrative of actual or at least realistic events (CSU Writing Guide, 2003). Attempts were made to obtain the contextual background of each problem, and conclusions were later drawn from each. The researcher attempted to obtain details of the cost prediction benefits generated by each case study, using the provided project details and observations.

The focus of this research is risk management and the cost planning of building projects in Kenya. The five case studies aimed to ascertain the nature and extent of the provision of cost planning and risk management services provided by the quantity surveyor. The study includes both case cost histories and some detail on the people involved.

In the selection of the informants for the study, the researcher had to consider the interactions of quantity surveyor with the other consultants involved in the preparation of cost planning for the project, and therefore a broad spectrum of projects and parties was interviewed. The five interviews involved the quantity surveying, architectural, project manager, client and resident engineering firms.

The first case study involved a very small project with simple design and details. The design was complete before the quantity surveyor was given the details necessary to produce a cost plan. The information required for the work required was all available since the project drawings were complete and handed over to the quantity surveyor in good time but, as very often happens, the client wished for additional works to be added to the project. It is the researcher's assumption that there was thus a failure in the briefing that the quantity surveyor used to arrive at the cost plan for the project. In the case study the questions were directed to the quantity surveyor with the aim of eliciting details of the cost planning and risk management experienced in the project.

The researcher looked at possibilities for the next case study and came to the conclusion that it would serve a good purpose to involve an architectural firm to answer questions on the cost planning and risk management of the project. This was because architects are traditionally in charge of project financing on behalf of the client. A medium-sized project where all the consultants were involved in the cost planning was therefore selected. In this particular case the architect was selected to participate in the research due to the influence he had on the development and the project cost plan. The client was somewhat pressured by the need to have the building completed by a set date but kept varying the design, thereby causing task disruptions and contract period extensions.

The cost planning problems seen on the next two projects may have been the result of the client not giving adequate information in the original brief. For the third case study, the researcher deemed it necessary to look beyond the client and check whether the client representatives had received adequate information from which to brief the consultants. The client representatives, such as the project manager, should be conversant with the details of client requirements. Thus it was decided that the researcher would work with the project manager through a turnkey project[12]. All the details had to come from the design and build offer. In this case the estimate was based on the cost knowledge and experience of the quantity surveyor.

Often the combined efforts of members of a building team need to be applied to develop a cost plan. In the fourth case study, this was expected from a team that had been working in the same environment for a long time. Projects using forward-planned funds would be like those undertaken by a government or a local authority, where standard drawings and cost rates are consistently used in formulating forward-planning budgets for projects. This was a city council project where the informant was the client, in a refurbishing and renovation project. It offered a good opportunity for investigating the standard procedures used, and knowledge-based cost planning.

The last study investigated a case where checks had to be made on the cost planning done by an engineer within a client organisation. The client's chief project engineer was involved in throughout the project's planning stages as resident engineer in charge of creating a budget for the project and

[12] All the work being done by a single contractor (who may however employ subcontractors).

planning for its utilisation. At the same time he acted as departmental head to see that the money allocated for the development was utilised in the best way possible. Projects with this type of arrangement are often seen with property developers and investment agents such as banks.

7.4.6 Use of non-participant observation

In the questionnaire survey it had been found that the respondents were not experienced in risk management. They lacked large-scale risk exposure and therefore risk management application (see Chapter 6, Tables 6.6, 6.49 and 6.50), although most of the respondents claimed to be familiar with risk management. The engineers stated that they were not familiar and had no experience with risk management. The quantity surveyors, not surprisingly, had more experience than any other group but it was still necessary to explore their experience in budget prediction. The remaining disciplines showed a lack of risk management experience. Given the increasing emphasis on risk management and cost planning of building projects, the researcher decided to test the risk management knowledge that was available in building projects through observation of risk management application by the building professionals.

The information gathered by direct participation in collecting respondent's reports was likely to be accurate, particularly when collected in the subject's natural setting. Information collected on budget prediction and performance during risk management would shed some light on current risk knowledge and experience. A fresh narrative of a case history would provide a suitable medium of observation, and the stories told would, it was hoped, confirm the questionnaire results regarding risk management.

7.4.7 Use of the interview approach

The questionnaire opinion survey brought forth some findings on current practice. It was essential that the interviewees should challenge their own questionnaire responses, in order to confirm these opinions. The case study interviews would allow the respondents an opportunity to challenge results that were obtained from the questionnaires, and the researcher would learn from the informants by engaging with them about their ideas and opinions of risk management in cost planning. The researcher could reflect then on information gathered and finally the interviewee would help in refining the research findings and the contribution of the research to the body of knowledge (CSU Writing Guide, 2003).

7.4.8 Case study interview design

To obtain adequate insights on significant risk factors influencing risk management in cost planning, the researcher needed explicit questions to explore the nature and extent of the cost planning and risk management skills of each informant.

A case study interview format was appropriate for gathering specific information from particular selected projects with directed predetermined probing questions, which were used as the challenge, in a controlled format. The researcher acted as a non-participant observer. The case study interview gave the researcher an opportunity to interact with each of the respondents and observe their project environments.

The case-based questions were asked in face-to-face interviews with the project participants. The questions were flexible and were expected to generate discussion with the respondent. Questions were to guide the discussion and recordings of responses were made by the researcher (with the participants' permission). In recording the discussions, chances for inviting opposing opinions given as 'other' and 'don't know' alternatives were allowed. The directed questions and discussions therefore provided for alternative opinions by opening up other possibilities.

7.4.9 Concerns in the case study

The questions put to the informants were based on the substantive issues of cost planning and risk management that had arisen from the questionnaire survey. Some issues needed more clarification from the respondents, so they were asked further questions relating to particular areas.

To start the discussion, the informants were asked to discuss the way they created a cost plan in their last project. For example, the quantity surveyor in the community project was asked about his method of arriving at the cost budget that he forwarded to the client, through the following type of question: How do you use different price data with the different estimating methods to compile a final building estimate (cost budget)? This was done in an attempt to establish the nature and extent of the use of data, together with the necessary experience, to arrive at a cost estimate. In the questionnaire survey it was observed that lack of quality information and adequate experience in large construction projects had limited the extent of application of traditional estimating methods.

Important issues that needed to be addressed before the case study interviews were selected, based on the following criteria: contract sum, project size and complexity, project currency, amount of information available and willingness to communicate.

Appendix 1(guide questions asked in the case study interviews) gives the questions asked in the case study interview, together with the reason for asking each of them. This addressed the ten selected issues identified in the research problem in greater depth than in the questionnaire opinion survey.

The open questions allowed general discussion and peripheral comments to be noted, adding support to contextual evidence. Similar approaches to case studies in construction projects had been adopted by Edwards (2001) and Walker (1997).

The questions were created from issues emerging from the literature and the responses from participants in the postal question survey, and the findings were reviewed together for further investigation.

Project details and data were collected using the question format in face-to-face interviews with senior persons within the participating firms and organisations.

Significant findings were discussed with professional building cost consultants, to help understand the relevance of findings in a budget prediction environment – as feedback to the originators of the data.

7.5 Composition of the case reports

In this section the nature and extent of the reports developed for the case study interviews are presented. This was aimed at establishing the type of reports used to represent the gathered data summarised by the researcher. The summary of the composition of the case reports is discussed in two parts, namely; the criteria used in composing the report, and the units of analysis used for the gathered data.

The rationale for composing the report in these two sections was that the type of report has to be known before the data recording and the units of analysis are established, to show the format adapted for recording the information.

A case study is concerned with a whole variety of traits to be found in a particular project, but the purpose of the case analysis was to look for repeated observations among the data. Therefore a linear analytic structure was used in formulating and building up the case explanation from repeated observations. Thus the pattern of meaning derived from the observations was utilised, to compose single case reports. The results of the explanation-building from each case created a cross-case analysis from which the conclusions were drawn (see Yin, 1994).

7.5.1 Criteria used in composing the case reports

The level of experience and knowledge required in a particular case, and the willingness of the relevant participant to expose that information, determined the incorporation of each project into the case-study interview set.

Project particulars helped the researcher assess whether or not an adequate level of information on risk management in cost planning and control had been identified by the interviewee as a risk indicator.

7.5.2 Units of analysis

Interpretation of the data was done holistically by drawing conclusions based on the case histories and the cost information given by the interviewee (see CSU Writing Guide, 2003). The similarity of questions assured identical recording, using similar units (see Walker, 1997).

Each case study was a suitable unit for evaluating gathered project information in a budget environment and the case-based interviews were made into a budget entity in themselves. Moreover, each case study lay within a unit, for which a single budget was proposed, accepted and managed. Risk cost impacts could thus be quantified, assessed and later incorporated into the budget in the context of one specific case study, making that case study one unit of analysis in which risk management occurred (Edwards, 2001).

7.5.3 Validation of case study data

The information gathered was validated by using selected questionnaire survey respondents to corroborate the facts and evidence from the primary survey data (Yin 1994). The open ended discussion was provided with a guide to control the discussion. Later, after concluding the discussion, the informants were given an opportunity to question the information gathered with them at the end of the visit to their offices and work places.

7. 6 Conclusions

This chapter discussed the methodology that was followed in the case-study interviews.

A justification for the case-based approach in investigating specific project case histories and some financial risk issues raised in the literature survey was developed. This showed the need for an open, directed question format and for face-to-face interviews with the respondents. The question format was used to capture data for the case report and narratives.

The method of the case study reports was explanation-building and making repeated observations. The various case study interviews produced a holistic understanding of the events described in the case reports.

The case reports are presented in Chapter 8.

CHAPTER 8

Case Study Analysis

8.1 Introduction

Chapter 7 proposed a case-study protocol to investigate issues raised from the questionnaire results. In this chapter the case study report is presented from the five selected case studies.

The basic approach to gathering information through the individual case study interview was to attempt to discover relationships in the cost planning and risk management process, keeping in mind the significant theoretical issues developed in Chapters 2, 3 and 4.

The case study analysis is presented in five sections:

- linkage to the literature and the questionnaire survey
- preliminary case studies
- main case studies
- discussion of the multiple case analysis
- conclusion.

The rationale for conducting the case study analysis in these five sections was, firstly, that a linkage to the completed questionnaire and literature had to be established before analysis could take place. The preliminary case study was approached using a small project, to get a feel and direction of the flow of the questions in the main case studies. After the case narratives were established, the ideas collected had to be linked through a discussion of multiple case analyses, which is followed by the conclusion to the chapter.

8.2 Linkage of the case studies to the literature and opinion survey

The variables to be investigated through the case studies originated from the literature survey and the issues raised from the questionnaire survey. Therefore case narratives provide a link between the literature and contemporary knowledge of risk management in the cost planning and control of building projects.

The composition of each case report allows for gradual explanation-building in the narrative report, refining the ideas, establishing important aspects of case history, and formally judging the entire array of revelations following the chain of case evidence as it is discovered in the interview. Case narratives and histories contain outstanding events, and are used in this chapter. Narratives are easily remembered, showing creative and innovative cost ideas observed in specific projects linking literature and field knowledge to specific case applications.

8.2.1 Case narratives

The case study interviews were conducted during February 2001 and March 2001 and each case study, with its professional building cost participant (interviewee), forms a unit of analysis in the context of knowledge and experience of budget prediction.

In order to maintain confidentiality, the names of projects and their participants are not revealed directly but they are given a working name and the interviewees named according to the professional discipline (see, for example, Rwelamila, 1996). The information was sourced from the building clients, architectural, quantity surveying and engineering firms that were involved with building work as building clients and consultants.

The cases were divided into two groups: two preliminary cases and the three main cases. The grouping enabled the case studies to expose real-life project situation and increased the diversity of case knowledge and experience in building risk (CSU Writing Guide, 2003). The main-case investigation was sub-divided into small, medium and large projects. In that way a broad picture of Kenyan building sector cost practices would be obtained.

The case-study investigation was carried out in the following order. Investigation commenced with a small project with a gross value of less than 5 million Kenya shillings (KShs) (US$ 67 000[13]) followed by another small project with a value of KShs 5.1 to 25 million (US$ 68 000 to US$ 330 000). Then two medium-sized projects with values from KShs 25.1 to 100 million (US$ 330 000 to US$ 1 300 000) were investigated, followed finally by a large project with a value of over KShs 100 million (US$ 1 300 000). The range in values was chosen, firstly, to make sure that there was coverage of all possible cost opinions from the Kenyan building sector spectrum. Secondly, they were chosen to cover potentially diverse opinions from building cost consultants, using the selected range of values generated by the different sizes of projects.

[13] US dollar figures are converted at approximately KShs 75 to 1 US dollar.

The rationale for selecting the five firms or projects – as opposed to individuals – was that these were registered firms with many years of experience in the building industry. Individuals are likely to lack the accumulated knowledge found in organisations, which could be used by all employees in the firm. The clients were selected on the basis of an approved building plan that had been submitted to the council. They were therefore selected for their current active participation in the construction sector.

8.3 Preliminary cases

The two preliminary case studies were selected for their simplicity. The aim of this study was to obtain direction for the case-based research strategy. Yin (1994) claims that preliminary studies are not simply a pre-test, but can be considered as an integral part of the study in developing the explanation building. For this reason two projects were used to get a 'feel' and direction for when the informants in the main cases were interviewed.

8.3.1 Small size project: welfare society community centre

This project was selected because it had only recently been completed. The building team members were the quantity surveyor, architect and engineer who had been involved in its successful completion.

8.3.1.1 Project description

The project was a community centre, developed by a suburban welfare society in Nairobi. External consultants, including the project engineer, the project architect and a quantity surveyor, managed the project on behalf of the client.

On 23 February 2001, a face-to-face interview, lasting for 45 minutes, was conducted with the project quantity surveyor in the consultant's office. It provided the following information: at the time of the interview the project had been handed over to the users, to test the quality of the facility during the standard six-month defects liability period.

8.3.1.2 Budget cost experience

The project was estimated to cost approximately KShs 5 million, but the welfare society had KShs 5.26 million in the project account. The quantity surveyor interviewee had advised the society that they would spend approximately KShs 5.4 million on the project. Meanwhile, the lowest tender sum amounted to KShs 6.9 million.

At detail design stage, the community had decided to have a larger hall downstairs, eliminating several walls, in addition to extending a room upstairs. Library fixtures and fittings were not part of the original estimate and had not been included in the set building budget. It was later decided that these would be part of the building contract. A boundary wall was then added to increase the security of the community centre. All these items contributed to extra costs, far exceeding the original predicted budget.

Despite the project being simple, there was an extension of the contract period and, as the project developed, the client permitted cost fluctuations. For example, the original contract period was six months, from 26 February 2000 to 8 August 2000, but the contract was extended for a further period of 26 weeks. The final building cost amounted to KShs 8.3 million. A cost overrun of KShs 3.3 million (a 66%increase compared to the original estimate) was thus incurred over the contract sum.

In the opinion of the interviewee, and comparing the size of the project and time allowed, the project was subject to extensive variations. In spite of this, the interviewee was of the opinion that the time extension was relatively high – to the extent that cost planning and control advice had not represented an accurate budget or contract period.

8.3.1.3 Summary of interview with quantity surveyor

The nature of the price data: The traditional selected procurement system was used, with bills of quantities, and the rates were derived from similar earlier projects.

The accuracy of the cost advice: Budget variation was caused by two risk factors: firstly, the absence of a good cost database, and secondly, the amount of design information available at project inception. These two risk factors exposed the budget to inaccurate prediction.

Potential to assess budget costs: Intuition, judgement and experience were used in assessing the risk components of the final building budget.

Implementation of risk analysis techniques: In the opinion of the quantity surveyor, risk analysis techniques were implemented appropriately at the tender stage of the project development.

Cost impacts and the budget experience: The risk factors that had the greatest cost impact on the community centre were the quality of the design information and the brief uncertainty.

Frequency of financial risk occurrence: The most frequently occurring risk factors were the quality of the design information, the incompleteness of design, and design variation.

The typical response to financial risk: There were two likely risk factors: the conditions of the contract and the quality of the design information. These were responded to in this project by retaining the risk and increasing the budget.

Options for risk management strategy in building budget: There were two options for risk management in the community centre project, that is, consultants retaining the risks and increasing budget, or consultants avoiding the requested design variations by refusing to implement the design changes.

Communication of likely cost impacts: The communication of likely cost impacts was complicated by the adapted approach of risk management in the community centre project. First of all, management problems such as cost overruns and abandonment of the project could not be communicated at the start of the project as adverse events were prompted by the client's new requirements.

Secondly, the professional building cost consultant communicated financial risk dangers on the community project to the client on one occasion only, and that was on time delays and the likely suspension of the project due to design changes.

Thirdly, notice of restarting the work once it had stopped (temporarily, while further instructions were awaited from the client) could not be communicated to the client in good time, as the building team had not known the extent of the client's financial commitment or the source of building funds. The consultants attempted to communicate with the client about the cost of restarting work when it had been stopped, but the risk could only be communicated when the likelihood of its occurring had been noted from the contractors' actions. Two risk factors were observed under communication risk indicator in this project: the types of client and the project management structure.

Problems in the cost budget assessment (estimating problems): The interviewee believed that the problem with the set (predetermined) budget was poor briefing from the client at project inception. The end-user input was lacking until a comprehensive design was completed. This resulted in inaccurate budget prediction and poor cost planning.

The type of client in the community centre project caused a lack of site input and brief-uncertainty risks.

8.3.1.4 General comments

The interviewee responses indicated that the contract period was not regarded as a high-risk factor, although time was critical to the society's activities. The interviewee maintained that the client was not aware of time and cost overrun risk. However, it would have been financially prohibitive to motivate the community members to come together to revive an abandoned project. The twenty-six weeks contract period extension allowed the client adequate time to call a meeting to organise the raising of extra funds.

The completion time required for the project was given little consideration in the budget prediction but the cost impact arising from time delays had severe financial implications for the predicted budget. The cost implications of delays and time extensions were ignored by the society.

The quantity surveyor believed that significant risk would only arise from financial risks caused by the likely suspension of work and the restarting cost implication. Such an eventuality would be particularly expensive in terms of time and cost.

There was little time allocated between the inception of the project and its detail design stage, causing the interviewee to produce a budget that did not articulate all the expected changes. Moreover, there was little consultation between the project participants and the client. There was too little involvement by the client in the development of the project, and the information gathered from the society to aid cost prediction was minimal.

At the same time, this project suffered from both the contract period being overrun and brief uncertainty. These are two major risk factors influencing budget prediction. It was observed by the researcher that knowledge of risk occurrences could directly reduce the influence of both of these.

8.3.2 Medium sized project: secretariat headquarters and offices

The secretariat headquarters project was selected for two reasons. First of all, the project had an experienced architect. Secondly, the secretariat was well-funded with predefined project drawings and a knowledgeable client.

8.3.2.1 Project description

The secretariat was a three-storey building, with two boardrooms, the office of the executive secretary, the chairman's office, and conference and seminar rooms. The building was located at close proximity to a major highway, and next to a stadium.

The building team for the secretariat headquarters included an architect, structural engineer and quantity surveyor. The researcher met the architect on site to discuss the cost background of the project.

The architect, who had 18 years experience in building design, was commissioned by a certain Kenyan sporting body (hereinafter referred to as the SB: Secretariat Building) to prepare design sketches for their consideration. These were discussed and the architect was requested to establish the likely cost of the design.

The researcher asked the project architect to give a brief cost background to the project. The interview time lasted slightly over 40 minutes and provided the following information:

8.3.2.2 Budget cost experience

The interviewee firm was expected to provide the SB with the cost advice and a suitable procurement system for developing the project. After the designs were completed, the quantity surveyor was appointed by the architect to prepare the bills of quantities. Bills were then prepared from the completed design on which the contract bids were based.

The architect used the traditional selected procurement system, bills of quantities, and the standard conditions of contract. Tenders were invited from the Ministry of Public Works list of registered contractors and the tender was awarded on the basis of bid price and experience in that type of work.

The SB, as the project client, had a budget of KShs 18 million for the project. The awarded contract sum was for about KShs 16.3 million while the final project cost was roughly KShs 21.7 million. The contract period was for 6 months, from 15 August to February 2001, with no allowance for time extension.

There was little design variation despite complaints of poor project communication between client and building team.

8.3.2.3 Summary of interview with project architect

The nature of the cost and price data: The informant (the Project Architect) had wanted the traditional selected procurement system and the bills of quantities to be used in the project execution. The contractor entered into contract using a modified form of the standard contract conditions from the Ministry of Public Works, and the bill rates used in the budget prediction were derived from previous similar projects.

Accuracy of the cost advice: The interviewee offered reasons for lack of accuracy of the cost advice in cost planning and control. According to him, lack of a suitable estimating method, the quantity surveying consultant, and a lack of communication between the parties were major constraints on budget accuracy.

Potential to assess budget costs: The architect preferred to assess budget costs using intuition, judgement and experience because this method had the potential to accurately assess the risk components of the final building budget. According to the interviewee, the method was identified by the members of the building team as a good cost prediction technique, and in any case the architect was not familiar with any other risk analysis methods. This is supported by the literature, for example Akintoye and Fitzgerald (2000) claim a lack of knowledge from cost advisers on their cost planning functions.

Implementation of risk analysis techniques: In project development, risk analysis techniques should be implemented appropriately at inception and at brief, feasibility and sketch design stages. The tool of risk analysis requires mathematical skills and other external inputs, adding service cost to the client. These findings concur with those of Akintoye and Fitzgerald (2000) and Mok et al. (1997) who found, for example, quantity surveying consultants and building service engineers still using tradition methods for estimating building services.

Cost impacts on the budget: The risk factor that had the greatest cost impact on the budget was size of the project, whereas the complexity of the project and the experience of the quantity surveying consultant had little cost impact on the project and therefore did not influence budget prediction. The indecision of the client on the positioning of certain facilities was a critical issue in this project, in particular the facility layout and size which were changed to fit end users' wishes as the project was being developed.

Frequency of financial risk occurrence: Design variations and the type of client were the most frequent risk factors in this project. The building end-users and the client interfered with the designed spaces causing cost impacts to the predicted budget.

Responses to financial risk: The architect used two risk responses in this project. They were: retaining some risks and increasing budget, and partially mitigating the risk exposures by transferring some risks to other parties. Retaining the risk and increasing the budget was a response to the size of the project, and the quality of the design information was improved to reduce the cost impact. The conditions of contract transferred the bulk of other building risks to third parties.

Options for risk management strategy in the building budget: The architect had to set up a budget plan and establish cost limits with the design team as a risk management strategy.

Communication of likely cost impacts: The client occasionally received communication of the likely cost impacts. These would deal with issues such as the likelihood of cost overrun or the effect of time delays and time extensions. Communication of these risks was done when the situation demanded such an action.

Problems in cost budget assessment (estimating problems): In the opinion of the interviewee (the project architect), there was frequent indecision by the client on matters needing further instructions on changes. This in turn created variations in the project, causing time delays and extra costs.

8.3.2.4 General comments

There was adequate preparation for this secretariat headquarters project. Money had been put aside for the project development and the client was waiting for an opportunity to show their achievement in managing the SB association. The building was to be a reflection of that achievement.

The SB had invited an official of the international sporting federation who was to come into the country at that time to officiate in the opening ceremony of the building, and a date for that had been fixed in advance.

The remarkable commitment to building progress was excellent and the building was completed within the secretariat's predetermined deadline. This was despite the clients' constant design changes which were a hindrance to the smooth running of the project. These occurred because personal and individual wishes had to be incorporated into the designs during the construction period.

The secretariat building project suffered from two major risk factors; the type of client and design variations.

8.3.3 Summary of the preliminary cases

The two informants had different perceptions of budget roles and in order to emphasis these factors independently the researcher had to establish their opinions and indicate the links, directly or indirectly, as pieces of information were assembled to make up the whole cost picture.

The required clarification of financial risk issues was made possible through the guided case-study interview so that the survey issues needing further investigation could be resolved satisfactorily.

The community project gave the researcher the opportunity to observe that the quantity surveyor lacked control and management over the brief and period overrun risks.

The secretariat headquarters project management gave the architect the power to exercise control over the budget. However, this project suffered from two major risk factors; the type of client and design variations. Moreover, the architect, though given a free hand in funds expenditure, had to contend with changes demanded by the client during construction.

After the two pilot interviews, the researcher decided to focus the rest of the investigation on client-controlled projects because a significant number of financial risks were observed by the researcher to have been generated by the client's active involvement in the project management.

The following three main case studies were then selected, all focusing on the 'type of client' risk factor. Projects directly managed by clients would, it was hoped, illuminate cost experience and create an understanding of financial risk management in budget prediction. Moreover, clients might have caused design changes and period overruns that could be explored through selected cases.

8.4 Main cases

Explanation building in the preliminary cases confirmed theoretically significant risks drivers such as type of client, design variation and brief uncertainty. Others, for example, bills of quantities, level of completion, size and complexity of project were also observed to be important risk indicators and finding any causal links between them may aid risk management.

8.4.1 Case study one: small size project (factory building partitioning)

8.4.1.1 Project description

This project was the partitioning of a large exhibition hall, located within the 'Export Processing Zones' (EPZ). These EPZ's were established in Nairobi and Mombasa to encourage small-scale manufacturers to set up industries for manufacturing goods for export in specially-designated areas. With this aim in mind, the EPZ Authority board had sourced funds and had already had a large factory floor constructed that was to be shared among many tenants. The floor of this large building now had to be partitioned, to accommodate 30 or 40 small industries, thereby meeting the needs of the small-scale entrepreneurs.

This factory-creation project had raised a lot of public interest and for the majority of small-scale entrepreneurs, who had shown an interest in the project, speedy completion of the partitioning was very important. The project was selected by the researcher because it had generated a lot of public interest with regard to the type of cost management applied in arriving at the contractor's design-and-build procurement system.

8.4.1.2 Interviewee A: Project manager

The interviewee was the project manager, and he was asked by the researcher to give a brief cost background on the project, resulting in the following information.

8.4.1.3 Budget cost experience

The procurement system for the project was design and build. Tenders were invited from a list of five contractors selected for their knowledge and experience in this type of work. The successful tender was awarded the contract on the basis of both their price and their partitioning proposal. The project was managed by an external team of consultants under the control of an in-house project manager.

The manufacturing process was sensitive to the timely completion of the project, as the tenants had already paid in advance for the use of their proposed floor spaces. The project was aimed at adding more manufacturing space to local entrepreneurs and failure to complete project in time would endanger market opportunities for the new firms.

The project was budgeted at KShs 11 million and the contract was based on approximate quantities, subject to re-measurement on completion of the works. The final project cost was KShs 9.9 million. The contract period was for one month and a one-month time extension was negotiated during the duration of the contract. There was little design variation and project communication between the participants in the project was good. The original contract period was from 2 January 1992 to 2 February 1992.

8.4.1.4 Summary of interview with project manager

The nature of the price data: Interviewee A preferred the traditional selection procurement system and provisional quantities. Tenders for the partitioning project were based on agreed price schedule calculated from first principles. The superficial method of cost assessment was used initially due to lack of partition details for budget prediction and contract bidding. The contractor had to tender the intended design and build it to the agreed specifications.

Accuracy of the cost advice: Interviewee A gave reasons for the lack of accuracy in costing, which were lack of expertise and the relative inexperience of the consultant, project characteristics and the type of communication between the parties and their project based on the works per square metre method that was also not accurate.

Potential for assessing budget costs: In the experience of interviewee A, the 'intuition, judgement and experience' method had the potential to accurately assess the risks in the building budget and therefore the interviewee used this method, as it was deemed a good cost prediction technique.

Implementation of risk analysis techniques: The project manager was of the opinion that risk analysis techniques were implemented appropriately at the inception and brief stage of the partitioning project.

Cost impacts on the budget: Interviewee A believed that the complexity of the project was the risk factor that had had the greatest cost impact on the partitioning project.

Frequency of financial risk occurrence: In the opinion of the interviewee, the quality of the design information and the complexity of the project were the most frequent risk factors to occur in this project.

Response to financial risk: According to the interviewee, two risk responses were recommended: partially retaining and partially mitigating the risk exposures. Retaining the risk and increasing the budget was a response to the location (because the substructure was very poor). Risk factors such as the quality of design information, the size and complexity of the project and conditions of contract were mitigated by the transferring of risk to the contractor.

Options for risk management strategies in building budget: The project manager ensured that the original cost plans were not exceeded by the contractor's tenders. The surplus funding enabled the interviewee to disregard budget prediction in the project risk management. The management established advance cost limits which the bidders had to follow.

Communication of likely cost impacts: Interviewee A said that he did not communicate any of the likely cost impacts to the client because of the *ad hoc* nature of the project management structure. There was no formal project management structure set for reporting project problems but in case of project abandonment or other serious project concerns a board meeting would be convened for the purpose of solving the arising problem.

Problems in cost budget assessment (estimating problems): In the opinion of the project manager, cost budgets do not work, thus indicating a possible failure in financial risk management.

8.4.1.5 General comments

There was little time allocated between the inception of the project and its detail design stage. The budget was already determined and in spite of this there was little active control by the client during budget prediction. The financial responsibility of the project manager was to manage the partitioning expenditure funds.

The partitioning project did not have any major risk impact as it was managed with a flexible budget.

8.4.2 Case study two: medium size project (renovation and refurbishment)

8.4.2.1 Project description

A local authority's desire was to renovate its office, which had been built 50 years previously. The building was to have new finishes, enhancing its appearance. The council's intentions were to upgrade the floor, wall and ceiling finishes, thus improving the internal appearance of the corridors and offices. The work also included constructing a remodelled entrance lobby to change the image of the council building.

8.4.2.2 Interviewee B: Client's representative

The renovation and refurbishment project was selected because of its reactive management style and because the client was willing to reveal cost insights on the escalation of the contract.

8.4.2.3 Budget cost experience

This renovation and refurbishment project was done as an in-house project involving the council's own quantity surveyors, engineers and architects. The section head was asked to give the cost background to the project and was provided with the following information:

The traditional procurement system, bills of quantities, and the standard conditions of contract were used. Contractors were requested to bid through an open procurement system. The final list of the selected contractors was displayed at the city hall and those interested were to collect bidding documents after payment of a non-refundable fee to the council.

The successful tender was awarded the contract on the basis of cost experience and quality of workmanship produced in previous council projects. The project was estimated to cost KShs 67 million. The contract sum amounted to KShs 83 million. The final renovation and refurbishment cost had not yet been determined at the time of this interview, as the works were incomplete and the council had defaulted in payment. The contract period was seven weeks from May to June 1999.

The contract was tendered on a fixed cost and time while the works were designed to create minimum work disruptions of the council's activities. A fluctuation clause was included in the contract to cover quantity and price changes. In addition, communication channels were created to accelerate the works. There was little design variation and good project communication existed between the client and the building team, although the client was not meeting progress payments obligations.

The budgeting problem experienced in this local council project was inadequate funding and the client's indecision to expedite the project promptly. The client later ceased to honour the interim valuation because the project account was depleted of funds.

8.4.2.4 Summary of interview with client's representative

When the sponsor (head of section) was asked to give a cost brief background to the project, the following information was noted:

The nature of the cost price data: The traditional selected procurement system, bills of quantities and standard forms of contract (with quantities) were used. During budget prediction, cost-price rates were derived from previous similar projects.

Accuracy of the cost advice: According to Interviewee B, cost planning and control advice did not represent an accurate budget for several reasons, the most influential of which were unforeseen market conditions, fluctuating prices and poor construction records. In the opinion of the interviewee, market and cost records caused budget inaccuracies in renovation cost advice. Interviewee B pointed out other factors causing inaccuracy of the cost advice, such as the poor cost database, the experience of the quantity surveying consultant and the type of communication between the parties. According to him these three risk sources had a major influence on the renovation and refurbishment budget.

Potentials for assessing budget costs: Interviewee B believed that the use of intuition, judgement and experience offered the potential for assessing the risk components of the final building budget. This method was identified as a good cost-prediction technique.

Implementation of risk analysis techniques: The interviewee reported that risk analysis was used at various stages. The risk analysis techniques of intuition, judgement and experience were implemented, appropriately, at inception and brief, feasibility and at tender stages.

Cost impacts on the budget: In the opinion of Interviewee B, the risk factor that had the greatest cost impact on the budget of this project was its complexity, which was particularly high in the renovation part. The experience of the quantity surveying consultant and the quality of design information had an acceptable risk impact, while size, brief uncertainty and location had little or no impact on the budget prediction. According to Interviewee B, delays and indecision by the council staff regarding the colour and quality of finishes proved to be a critical issue in the project.

Frequency of financial risk occurrence: The most frequent risk factor to occur was the complexity of the project, and occasionally incomplete instructions affected the budget prediction. All other sources of risk, such as design variation and quality of design information, had little, if any, effect on the budget prediction of this project.

Typical response to financial risk: Interviewee B said that three risk responses were used in the renovation project. Firstly, retaining risk and increasing the budget. This was done by controlling the size of the project or mitigating expenses on risk exposures. The response focused on location, the expertise of the quantity surveying consultant and the quality of information. The third response was to avoid risks by changing the design to eliminate the risk. In this case the complexity of the project was reduced.

Options of risk management in the building budget: Interviewee B believed that the risk management option available to the local authority was to set up the budget plan, with the design team assisting in brief and cost formulation through the council treasurer.

Communication of likely cost impacts: The opinion of the interviewee was that communication of the renovation and refurbishment budget and the likely cost impacts was often passed to the council. However the council did not heed risk warnings on likely cost impacts, such as payment delays and postponement of work. The project constantly suffered from non-payment of interim valuations, time delays and unofficial contract period extensions.

Interviewee B said that inadequate funds, client interference (in the form of City Council decisions), political uncertainty and the client's indecisiveness impacted negatively on the set cost budget. Restarting the work and mobilisation costs should have been given greater consideration at the budget prediction stage.

8.4.2.5 General comments

There was inadequate preparation for this project. Money had been put aside to finance the project but the council may have redirected these funds to its recurrent expenditure, resulting in mismanagement of the project funds. As a result, the problem of recurrent expenditure with the project finance was a hindrance to the smooth running of the renovation project.

The major cost impacts in the project were the type of client, contract period overrun, market conditions and interest rate changes, as well as political uncertainties.

8.4.3 Case study three: large-scale project (banking hall and office tower project)

8.4.3.1 Project description

The project was the construction of a high-rise office tower developed by the bank as an additional facility for their expanding services. The tower block, with eighteen floors, was intended for lease to commercial users. Large banking halls with two mezzanine floors were needed to accommodate services within the same building.

The project was selected for the case study because of its size and the client's active management style. Banks are known for their expertise in funds management particularly when investing client's money and this was another reason why the researcher selected the bank tower project as a suitable case study.

The traditional selected procurement system, bills of quantities, and the standard conditions of contract with quantities were used. Contractors were requested to apply for pre-qualification and to pay a nominal fee for the contract documents. Their knowledge and experience in this type of work was an added advantage. The successful tender was awarded the contract on the basis of experience rather than on the tender price.

8.4.3.2 Interviewee C: Chief Engineer (Properties)

The bank's project engineer (chief engineer, properties) was fully involved in the day-to-day running of the project. When he was asked to give a cost narrative he readily agreed.

8.4.3.3 Budget cost experience

The project estimate budget was about KShs 1.67 billion although the contract sum amounted to KShs 1.695 billion, and the final building cost was very close to KShs 1.7 billion. The contract period was between November 1997 and February 2001, on a fixed cost and time contract. The floor layout and the building framework were designed for minimum work disruptions, as the site was large and easily accessed from all directions – even though it was located on a busy thoroughfare in Nairobi. At the time of the interview the banking halls and office tower were complete and were awaiting the official handing-over ceremony and occupation.

The budgeting problem experienced in this project was how to quantify many of the late-date instructions from specialist subcontractors as well as the high quality workmanship that was likely to affect productivity on site. In the early development stages there were unexpected design variations and communication problems between the building participants.

8.4.3.4 Summary of interview with project engineer

In the bank tower project, a pre-qualification system was used to select suitable contractors; they were required to submit evidence of their previous work, before entering into the contract.

The nature of the cost price data: The chief engineer on the project used the traditional procurement system of quantities and price rates derived from previous similar projects. Functional and elemental cost techniques were also applied with previous rates from similar projects. The engineer reported that a combination of traditional estimating techniques was then used to arrive at the budget cost.

Accuracy of the cost advice: In the opinion of the chief engineer, cost planning and control advice did not represent an accurate budget. The reasons offered were the extent of design variation anticipated during construction. Interviewee C believed that there were many risk sources in a project of this nature. For example, the size of the project occasionally affected the accuracy of budget prediction. There were also considerable expensive finishes that had to be decided on site and these caused cost uncertainties.

Potential to assess budget costs: In the bank tower project, experience and probability analysis were used as acceptable risk assessment techniques. No other risk analysis techniques were familiar nor were they used in budget prediction of this project.

Implementation of the risk analysis techniques: The chief engineer's opinion on risk analysis techniques was that intuition, judgement and experience was appropriately implemented at all stages of project development.

Cost impacts and the project budget: The interviewee believed that the risk factors that had the greatest cost impact on the bank tower project budget were the size and complexity of the project, and brief uncertainty. These three affected the project cost significantly but the experience of the quantity surveying consultant, the quality of design information and the location also had an noticeable cost impact.

Frequency of financial risk occurrence: The most frequent risk factor to occur was the complexity of the project, although from time to time the size of the project and the quality of design information affected budget prediction. Interviewee C was of the opinion that all other sources of risk, such as design variation and completeness of design had an effect on budget prediction.

The typical response to financial risk: According to Interviewee C, two risk responses in the bank tower project were retaining and increasing the budget, and mitigating the risk exposures to reduce the cost impact. Firstly, all risk exposures were controlled and responded to by retaining the risk and increasing the budget. Secondly, the best local consultants available in the field were appointed to manage likely risk impacts.

Options of risk management strategy in the building budget: Interviewee C believed the three risk management options that were chosen were vitally important to the bank tower project. The three risk management strategies adopted in cost planning and control of the project were establishing cost limits at feasibility stage, the design team assisting in the brief formulation, and a complete set of project designs to be made available before the budget allocation was discussed. In this project the Chief Engineer (Properties) was involved in the project from the design and construction stages, and as a result he could monitor the design variations and established cost limits continuously throughout the project's execution.

Communication of likely cost impacts: The chief engineer could communicate directly to the client on the likely cost impacts, such as time delays and contract extension. The result of the project management structure was that interviewee communicated all likely risks without hindrance.

Problems in the cost budget assessment (estimating problems): In the opinion of the interviewee, unpredictable economic changes and uncontrolled prices of building materials were major problems in the building budget.

8.4.3.5 General comments

No significant budget prediction problems were encountered. The design information and client brief were adequate and the chief engineer was always present in the project development process. There were few variations during the construction period. Specialist subcontractors who had previously carried out work for the bank were employed. They had experience in the quality of work needed in this project. Fortunately, building elements were rarely varied and the building generally used simple layouts.

The major risk impacts suffered in this project were brief uncertainty, complexity of the project and possibly inflation, as well as market conditions.

8.5 Discussion of the multiple-case analysis

In construction projects clients are exposed to financial risk as a result of final building costs exceeding the budget as determined by the professional building cost consultant. The professional building cost consultant has to use knowledge, creativity and innovation in cost assessment generated from case study practices. The specific acts or behaviour of the informants in the case study were not important but could a form the basis for a comparison of budget experience and project character resulting in the cost characteristic of each project.

Multiple-case analysis produces fewer themes than a questionnaire data analysis thereby simplifying evidence-collection between cases. The themes discussed in this analysis are:

- inter-case discussion
- financial risk management
- findings from the case study
- implications of the case study findings.

The rationale for conducting the discussion of the cross-case analysis in the first of these four parts was that inter-case discussion would establish a link between the cases studied. The discussion on financial risk management would show the existing knowledge of the informants. The findings from the case study and the implications for the research would show some of the opinions to be deduced from the case histories and narratives.

8.5.1 Inter-case discussions

Financial management, cost planning and control tended to be based on bills of quantities, and the resulting budgets were derived from the use of cost rates from similar earlier projects. Selected procurement systems were based on experience and the (often inaccurate) judgement of suitable bid rates and this was the preferred selection and pricing mechanism in budget prediction. It was revealed that in current practice the cost adviser is appointed late in the project and detailed cost information is produced before a budget is predicted.

The result on the use of bills of quantities in budget prediction shows consistency with the literature. For example, the case study confirmed the findings of Mok et al. (1997) and Uher (1996) that cost consultants continue to use traditional estimating methods in preparing case estimates and cost plans.

The interviewees believed that a detailed approach to budget prediction was inappropriate at the inception and brief stage of the project. Interviewee C, in the large project, found it difficult to distinguish a particular reason for the budget inaccuracy because, in his experience, cost prediction problems have many causes, which depend on the scope and nature of the project.

The major problems in budget accuracy that were observed and seem to have been agreed on by the three interviewees were a good cost database; quantity surveying consultants' experience, and the type of client. The case study confirmed the theory developed by Kaming et al. (1997) that inaccurate prediction might be caused by many sources of risk, such as inflation, inadequate planning and inaccurate estimating.

Intuition, judgement and experience were seen by the interviewees as a valuable tool in risk identification, particularly when accompanied by previous bill rate prices. The use of intuition, judgement and experience in risk identification, quantification and assessment was observed to be the preferred method of risk analysis. This method was seen to have the potential to capture and assess potential financial risks and their cost magnitudes. Unfortunately, the method focuses more on known cost impacts than on risk magnitude and its life cycle.

Quantifying risk and assessment by the bills of quantities method had the potential to capture cost impacts through intuition, judgement and experience. Intuition and experience in case cost assessment was used in all stages of project development of one case study (the refurbishment and renovation project) but in the other two studies it was used only sparingly to predict future cost.

The 'intuition, judgement and experience' method was used in all these projects at the feasibility and tender stages, and Interviewees A and B maintained that this approach produced a valuable cost tool. Interviewee C also used this method but differed by introducing probability analysis, not adopted by other interviewees, for financial risk quantification and assessment. These findings showed that decisions by risk managers are similar to those mentioned by Kim and Bajaj (2000), and 'intuition, judgement and experience' is still the preferred risk analysis method used by a majority of practitioners in Kenya.

Interviewees in the three case studies focused their current risk knowledge on possible cost budgets in order to cover for potential risks. In particular, Interviewee A, the project manager on the partitioning project, suggested an informal budget prediction without exploiting any cost trends or monitoring any known risks in cost planning and control. This respondent possibly did not need intuition and experience in the treatment of potential risks because his project was simple with short contract duration.

There were almost no explicit, qualitative risk analysis procedures used in the budget predictions of the three case studies. The interviewees attempted to improve building risk management practices in their projects by managing financial risks as they arose, but they did not by plan for them in the project budget.

The three interviewees concurred on the critical risk factors that were important to budget prediction, the complexity of the project, the quality of design information, the experience of the consultant and the completeness of the design. Similarities in approach to significant risk factors into risk quantification and assessment were documented in risk management but the responses to those risks differed, whether in mitigating, reducing or avoiding risks for the budget prediction. The case study results contradicted Gidado's findings (1996) on project complexity as the focal point of cost planning. Other risk factors have been found by Akintoye (2000) to be important to cost planning, for example the client's financial position and changes in interest rates.

Retaining the risk and increasing the budget was the preferred response to risk management. The interviewees were not familiar with conventional risk-analysis methods for quantifying and assessing reduction or mitigation of risk. The case study findings corroborate the assertion of Kim and Bajaj (2000) that there is a lack of familiarity with risk management concepts.

The inter-case analysis was tabulated, giving the participants' responses, to explore the financial risk management of each project, using the selection criteria set out in Chapter 7. Table 8.1 depicts the summarised responses of the case study responses to the interview questions.

Table 8.1: Inter-case Analysis

Theoretical and empirical issues	**Preliminary case studies**		**Selected case studies**		
Risk indicator in financial management	*Interviewee Quantity surveyor*	*Interviewee Architect*	*Interviewee A Project Manager*	*Interviewee B Client Sponsor*	*Interviewee C Chief Engineer*
The nature of cost price data:	Previous projects	Previous projects	Previous projects	Previous projects	Previous projects
The accuracy of the cost advice depends on:	Good cost data, always.	Consultant experience, always.	Consultant experience, always	Consultant experience, sometimes.	Consultant experience, occasion-ally.
Potentials to assess budget costs	Bill of quantities is good	Bills of quantities is good	Superficial method is good	Bills of quantities is good	Elemental is acceptable
Implementation of risk analysis techniques:	Intuition / judgement / experience	Intuition / judgement / experience	Intuition / judgement / experience	Intuition / judgement / experience	Intuition / judgement / experience
Cost impacts on the budget experience: A non-participant observation	Very high	Very high	Very high	Little or none	Acceptable / high
High Frequency of financial risk occurrence are generated by:	Complete-ness of design, always	Not applicable	Complexity of the project, always	Quality of design information but it is seldom or never	Complexity of the project but occasion-ally
The typical response to financial risk:	Retain and increase budget	Retain and increase budget	Mitigate risk and accommodate cost	Mitigate risk and accom-modate cost	Retain and increase budget
Options of risk management strategy in building budget :	Brief and cost formulation is vitally important	Setting up budget plan is vitally important	Establishing cost limits is vitally important	Setting up budget plan is important	Establishing cost limits is vitally important
Communication of the likely cost impacts :	occasionally	occasionally	occasionally	Seldom or never	Occasion-ally
Problems in the cost budget assessment (Estimating problems):	Poor instructions from client	Client indecision	Don't work/un-controllable	Refining the brief	Unpredict-able

Table 8.1 shows the participants' reliance on their experience, intuition and judgement in adverse events when dealing with project risks. It also shows that no formal risk management or conventional risk-enhancing techniques were used in the cost assessment of likely risk occurrences. The major risk factor is shown to be the complexity of the project, which can be identified, analysed and responded to through refining the brief and by establishing better cost limits for risk-management strategy.

The interviewees' responses tended to focus on known cost impacts instead of on risk probability and risk event magnitudes. There was little evidence in the three case studies of explicit project risk monitoring or of any risk control processes. In spite of this, intuition, judgement and experience were aimed primarily at identifying potential risk impacts rather than monitoring risk events and cost magnitudes. Thus intuition, judgement and experience were the preferred risk analysis alternative, rather than techniques needing mathematical manipulation.

8.5.2 Financial risk knowledge and experience in the case studies

For cost planning, contract documentation and cost administration services in the community centre and in the secretariat headquarters, implicit risk management experience excluded financial risk advice, checks on cost documents, reconciliation checks on project budget and progress valuations and payments. All these cost management services required that cost factors be analysed through reference to available updated case histories held in the office. The budget prices were obtained from specialist consultants and previous contract prices. The interviewees in the preliminary study projects believed that the cost rates used by the consultants and contractors reflected market prices, and for this reason they remained the preferred basis for budget formulation.

According to Akintoye and Fitzgerald (2000), cost consultants continue to use cost estimating for project cost planning and evaluation and the case study confirmed the use of detailed bills of quantities and assessment – even when details do not exist.

Bills of quantities were used in both the community centre and the secretariat-headquarter (SB) budget prediction, although the projects were at different levels of design completeness. Both the quantity surveyor and the architect interviewees believed that their projects, the community centre and the secretariat headquarters, projects respectively, were easy to evaluate on an item-by-item basis, as they were not risky. Both buildings had simple design layouts. The cost experience from the complexity of the project as a risk factor was, however, not in either of the two projects.

Exposure to complexity and size risk factors had been controlled or reduced except for the design variation and contract period overrun.

In the factory partitioning and bank tower projects, the cost experience from design variation and contract period overrun was avoided by providing project information and details sufficiently early. Despite the use of price rates derived from previous bills, the project developments had been arranged to avoid financial risks. Where such risks were unavoidable, time and cost overrun was reduced to a minimum, thereby decreasing the financial risk exposure of the project.

The quantity surveyor interviewee believed that his project needed minimum budget experience but the occurrence of design variation and contract period overrun risks proved this to be a wrong financial prediction, making the cost plan inaccurate.

The partitioning project was to be executed within one month. It was an ideal financial risk management project. The cost management experience gained from the project was, however, minimal, as there was little exposure to financial risk.

The secretariat project also exposed the client to minimal financial risk but both the partitioning and secretariat projects suffered from overruns, the former, from contract period overrun and the latter from cost overrun.

Interviewee B, the client's representative on the local authority renovation and refurbishment project, believed that political differences had been reduced by establishing reasonable cost limits. In-house cost managers had adequate risk experience as well as both the economic and financial experience which the project required. In this respondent's experience, council projects had time and cost overruns due to political uncertainties, City Council interference and payment distresses. In his view, high time and cost overruns emerged from lack of critical investigation and perusal of information. He felt that the client feasibility studies had been ineffectively carried out before the commencement of the project, so that the cost information generated later created severe management and political constraints on the budget prediction. For this reason, Interviewee B maintained that the project had high financial risk exposures from the start, which were due to the type of the client rather than to the lack of cost and financial planning.

Unlike with the renovation and refurbishment project, Interviewee C had no financial constraints but the size and complexity of his project brought into focus high financial risk exposures. The cost experience was the likely cost magnitude of an adverse event occurring in the budget prediction of the bank tower project.

The case study finding from the bank tower project was similar to Akintoye's (2000) finding as it showed that the client's financial position and the buildability of the project were significant financial risk indicators affecting budget prediction. The bank tower project did not experience time and cost overrun risk, due to good forward planning by the chief engineer – except by a very small margin of 2 per cent cost increase on the estimated cost plan. This contrasted strongly with the small community centre project which had a 58 per cent cost overrun.

Other risk factors, for example time delays or design variation, often cause considerable budget changes, which affect future incomes and create high losses for the client. A small risk event could be magnified by the size of the project, resulting in a budget overrun or a significant cost effect on cost prediction. The experience of such an effect was therefore considered by Interviewee C to be high, while the cost precaution of retaining risk and increasing budget was the adopted risk management strategy for budget prediction.

The view that high financial exposure gives cost management experience to building professionals reveals that there should be budget concern when selecting the procurement system and appointing the consulting team. The cost experience of Interviewees B and C indicated that retaining the risks and increasing the budget was the correct response to financial risk at project briefing stage. The opinion of Interviewee C on the bank tower project was that his financial management experience was enhanced by the quality of information and the level of completeness of design on this project.

Case study findings on complexity of the project and market conditions were the main risk factors relevant to cost estimating in the bank tower project. Akintoye's (2000) analysis of factors influencing cost estimating practice concluded that project complexity and the scale and scope of the construction were some of the important risk factors, and these were the type of factors that affected the estimate of the bank tower project.

The interviewees did not use an enhanced, explicit process of risk management to control and direct financial risk exposures by cost planning and control procedures. Neither did they offer a risk management service to clients unless specifically requested to do so by a particular client. In the opinion of the researcher, substantial budget prediction procedures and financial risk management practices minimise the potential occurrence of financial risk events that might lead to budget overruns.

8.5.3 Findings from the case studies

The overall findings on risk management practice drawn from the interviewees on case study projects A, B and C, were that:

- *There was limited formal risk management applied to budget prediction.*
- *Intuition, judgement and experience were the only method of risk analysis used by all respondents to identify and quantify risk impacts during risk management in budget prediction.*
- *There were important risk factors that had not been noted in the existing literature and should be considered in risk management at the budget prediction stage. These were quality of design information, brief uncertainty, completeness of design and conditions of contract.*
- *The interviewees were not familiar with quantitative risk analysis techniques.*
- *The interviewees relied on retaining risks and increasing the budget rather than on any other risk response technique.*
- *There was little or no evidence of project risk monitoring and control in the budget prediction process.*

8.5.4 Implications of the case study findings

The researcher's findings have the following implications regarding current risk management and cost planning and control practices.

- *Records of previous case study and market trends should be maintained for use in forecasting future projects.*
- *Bills of quantities used in case cost prediction should be open for checking, budget adjustment and addenda, to allow for future cost variations and design changes.*
- *The size and complexity of construction projects should be determined at project inception, to control and manage any resulting risks which might arise. This is because the application of formal risk analysis to construction projects was indicated to be limited in its applications.*

- *Intuition, judgement and experience techniques of risk assessment should be improved by further case studies of specific projects in order to understand building risk and the characteristics of risk management in cost planning and control.*

8.6 Conclusions

In this chapter, case-study projects have been analysed from face-to-face interviews based on cost planning and control, as well as risk management issues emerging from the literature survey. The analysis allowed conclusions on current risk indicators to be identified and the case reports were accomplished by explanation-building and making repeated observations in three ways:

Firstly, case studies identified risk practices, which act as risk indicators in current practice, such as the selected procurement system, the increased use of bills of quantities, and poor quality cost price data.

Secondly, the use of intuition, judgement and experience to identify, quantify and assess cost impacts was the preferred risk analysis technique although it was an informal technique. Interviewee experience with budget prediction showed that assessment of significant cost indicators was qualitative rather than quantitative.

Thirdly, knowledge and experience in project risk management was likely to be perceived differently by professional building cost consultants in the different disciplines and cannot be applied uniformly without procedural guidelines. At present such guidelines do not exist. The interviewees in the building disciplines were not familiar with the different risk management theories. In general, the informants were unfamiliar with and inexperienced in risk analysis techniques, and their projects suffered from financial risks.

In order to use more reliable cost assessment procedures, the measurement and qualification of risk factors and sources should be carried out through risk indicators. Such significant risk indicators as size, complexity, quality of design information, completeness of design and design variations could capture and incorporate building risks in budget prediction.

The risk management strategy undertaken by the interviewees was to establish a cost limit by brief and cost formulation, based on bills of quantities. The nature of risk response suggested by the interviewees was to retain the risk and increase the budget. In addition, the interviewees believed that a good cost database and satisfactory communication between parties contribute to effective budget prediction.

In spite of the presence of risk indicators, the focus of cost planning and control and risk management should be on bills of quantities, type of client and project complexity, rather than on risk analysis techniques only.

Financial risk management trends that were focused on risk indicators, such as the quality of bills of quantities, could be used to approach risk quantification and assessment by risk priority, cluster grouping and broad risk entities.

Financial risks can be suitably captured by bulk risk events that focus on cost effects and outcomes, represented as clusters or entities. Such risk assessment was not observed in the case studies. The criterion currently advocated for the quantification and assessment of risk in building projects, namely using risk clusters, was insufficient.

The case study projects confirmed the research problem stated in Chapter 1, that in construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget, as determined by the professional building cost consultant. This tends to support the hypothesis that the risk management function, as exercised by the professional building cost consultant in cost planning and control of building projects, needs to be improved. Greater discussion on the proving of the hypothesis is given in Chapters 9 and 10.

CHAPTER 9

Discussion of the Empirical Results

9.1 Introduction

Chapters 2, 3 and 4 explored risk variables from the existing literature in risk management and cost planning and control practices. Chapter 5 described the methodology utilised in testing the selected variables with clients' organisations, architectural, quantity surveying and engineering firms. Chapter 6 documented the analysis and interpretation from the questionnaire on the current practice of risk management and cost planning and control practices in Kenya. Chapter 7 presented the protocol for gathering information from the case study interviews to supplement the questionnaire opinion survey and Chapter 8 documented the case study interview reports and discussion.

The purpose of this chapter is to provide a discussion of the empirical results emanating from this research project. The discussion is presented in three sections, namely:

- discussion of the questionnaire and case study interviews
- Synthesis of results
- conclusions.

These sections were chosen because they cover the work done so far. The study started with the need to investigate the problem stated in Chapter 1 by a survey method that was supplemented with a more in-depth (case study) method.

9.2 Discussion of the empirical results in relation to the research hypothesis

This section reviews the significant results reported in Chapter 6 with reference to the hypothesis, literature on risk management and cost planning and control. The concepts that resulted from the study findings are expounded by reference to the case study interviews, the hypothesis and to give supplementary evidence to the main research study.

The principal problem under investigation was:

In construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget, as determined by the professional building cost consultant.

This problem was resolved through the discussion supporting the thesis:

The risk management function as exercised by the professional building cost consultant in cost planning and control of building projects is usually ineffective.

The analysis employed in this discussion is arranged according to the risk themes adopted in Chapter 6. The ten specific themes were:

- the nature of the respondents
- quantifying risk in cost planning and control practice
- information and data risk from drawings and project details
- accuracy risk in the costing of items
- frequency of occurrence risk in risk management
- cost impact risk in risk assessment
- response risk in risk management
- assessment risk in the treatment of potential risk
- communication of risk in the treatment of potential risk.
- Practice issues raised in budget assessment

In conclusion, the questionnaire survey findings are expounded by reference to interviews to support the findings and as evidence to supplement opinion findings.

9.2.1 Nature of the respondents

The findings in Chapter 6 showed a lack of large-scale project risk experience among all respondents. Those from quantity surveying and architectural firms were from small and medium-sized organisations with less than 5 members of staff working for such firms. The finding concurs with the Bowen (1993) finding in the South African construction industry that quantity surveying and architectural respondents constitute small to medium sized practices.

In Chapter 6 it was also shown that respondents lacked experience of large-scale risk management. Thus the amount of risk management experience of each firm depended on the amount of work experience with cost planning of building projects. For example, it was shown that the value of 40% of respondents projects ranged between 2.1 and 5.0 million Kenya shillings (KSh) (about

US$ 28 000 to US$ 67 000) and half of the respondents reported to have current projects of KSh 5.1 to 10 million (about US$ 68 000 to US$ 133 000). The majority of the projects handled by respondents do not exceed KSh 50 million (about US$ 670 000) and therefore the type of risk exposure from such projects is insufficient in terms of managing risk in large-scale building projects. The nature and extent of the practice of cost planning and risk management, the type of project risk exposure and the nature of the quantity surveyors and their clients hinders the development of better understanding and improvement of risk management in cost planning and control.

The Ministry of Public Works and the Building Research Centre maintains records of completed projects for use in the forward planning of public projects, but these are useful only for determining general funding of future projects. These records cannot be used for effective construction planning showing cost trends. Only the nature and extent of building risks could be deduced from the records as most of information provided is general, and the nature of the projects, the quantity surveyor and clients might not be specified in these records.

From the information in Chapter 6 regarding the nature of the respondents, three observations can however be made:

- *Risk management experience is gained internally without involving a thorough project risk investigation.*
- *There is limited creativity and innovation and the many attempts to use routine procedures in risk assessment do not produce a reliable budget.*
- *Engineering firms are better poised to undertake risk investigation design and construction work than the other consultants and have an opportunity to be creative and innovative with risks during pre-construction stages as they have larger staff establishments.*

The respondents involved were expected have knowledge of risk management theory and its applications. The case study interviews in Chapter 8 showed a need to institute guidelines regarding costs established and maintained by a central public body. The criteria used to select the projects and the informants were based on the contract sum and on the consultants involved and their experience – as well as their willingness to reveal project information.

9.2.2 Information and data risk in cost planning and control practice

In Chapter 6 the researcher observed that first budget information is often prepared and received at the detail design stage but always checked only at the tender stage. For example, a majority of all respondents always checked the estimated cost against the cost plan at the tender stage.

The client organisations reported that they did not use cost and risk planning information before the tender stage was reached. The late entry of the quantity surveyor into the project development process affects budget prediction because the other parties involved often delay in finalising the design or supply incomplete information while hoping to finalise that information as the project progresses. The inadequate information that is made available for cost and risk planning encourages the quantity surveyor to fill the information void with subjective information through creative thinking. The need for detailed cost guidelines to facilitate future cost planning puts pressure on budget facilitators to develop an appropriate solution for use at project inception, based on the limited information available at early project stages.

In Chapter 6, it was shown that professional building consultants use incomplete information in budget prediction at both the project inception and feasibility stages, whereas the quantity surveyors' cost advice is received at the detail design stage. Late changes in design, inflation, market and tender conditions that can affect the detailed predetermined budget may also occur.

The issues arising from the questionnaire findings showed that there is generally insufficient project information. This influences the quantity surveyor to rely on the previous cost information and data for the formulation of the client's budget prediction. Furthermore, the results show that the quantity surveying firms agreed that the amount of information available influences the accuracy of the estimated cost plan.

The case study interviews showed that informants depended on quality of project briefing from the client in order to compile a budget prediction of the project. For example, case study interviewees A and B were given inadequate briefs and had to rely on the use of bills of quantities to produce estimates. The inadequate cost brief given to Interviewee A, the project manager, and to Interviewee B, the client's representative, resulted in delays in issuing the first cost budget. The limited information from the brief and bill item rates from previous similar projects helped these interviewees compile early estimates. In contrast, Interviewee C, the project engineer, supplied sufficient project information for cost and risk planning for the bank tower project. Further, the influence of the project brief and the role of proactive participation in the brief establishment may enhance the effect of the case study and opinion.

The literature (e.g. Pender, 2001) on risk and cost planning and cost control has shown that early project information and data is inadequate for cost prediction and management, due to the unpredictable nature of building activities and events. Building events cannot be defined with certainty, so the incomplete knowledge of the future building development demands flexibility in cost management.

Thus, in summary, a lack of sufficient quality project information encourages the cost practitioner to be creative and innovative in supplementing the limited available project information at early project stages. This makes the risk management function of the cost consultant relatively ineffective in budget prediction. The research finding is therefore that adequate project briefing, including the presence of a competent client representative, would reduce information and data risk at early project stages.

9.2.3 Quantifying risk in cost planning and control practice

From the questionnaire results it was evident that bills of quantities are used extensively as the basis of budget prediction. For example, in Chapter 6 it was shown that a preference for this method exists in a majority of project contracts and that the quantity surveying respondents used it almost exclusively their projects. However, the practice of relying on quantifying risk by bills of quantities introduces financial risk and inaccurate cost plans of budget in building projects.

The late entry of the quantity surveyor at the detail design and tender stages did not aid quantifying of risk for two reasons. Firstly, it would be too late to apply any useful financial risk management and recommendations at detail design stage. Secondly, it would be of limited use to apply risk management when the project is far advanced in design. Late quantifying of risk from drawings might not help as a cost guideline to project development. Therefore, proactive quantifying of risk and early appointment of a quantity surveyor would be a solution to the current ineffective budget resolution.

The selected tender as a contract procurement method was used in a third of the projects. In such a situation the time taken to gather information and to quantify risk to guide a selected building contract is insufficient for extensive risk investigation, particularly at early project development stages. This was the reason why the first budget advice from the quantity surveyor was produced at detail design stage, when the future contract for the project was clearly defined.

Regarding the importance of the estimate to the contract procurement process, a great majority of the respondents indicated that the estimated cost plan was either important or vitally important at tender stage. This shows that the client did not consider measurement and quantifying of risk important before tender stage was reached. For this reason, the quantity surveyor is likely to be appointed late to advise on the project cost. The practice of appointing the quantity surveyor late has continued to affect cost planning processes in Kenya, and has become instituted into risk management practices.

The case study interviews revealed that there is a reliance on bills of quantities in cost prediction. The exception to the use of this method was illustrated in the first case study, the partitioning project, in which the client set out a capital fund for the partitioning without waiting for drawings. Drawings should be produced first if the selected tender method of contract procurement system is to be used, but in this project the project manager, Interviewee A, had decided to use the negotiated tender system. Other projects thus had to wait for the production of substantial design drawings before the first budget advice could be produced.

The finding that the client often sets out capital funds without waiting for drawings (e.g. in the factory partitioning project) showed the existence of human errors when interpreting available project information and quantifying risk.

The finding regarding the quantifying risk in cost planning and control was that bills of quantities continue to be popular among cost practitioners and as the future basis of project measurement and quantifying risk in building projects.

9.2.4 Accuracy risk in the costing of measured items

A finding from Chapter 6 was that one third of the respondents expected the accuracy of cost plans to be within 20% of the estimated final building cost and believed that the bills of quantities method had the potential to assess risk allowances sufficiently and accurately. Furthermore, the findings indicate that respondents regard bills of quantities to have the potential to assess risk in building projects to within 5% of the final building cost.

Bills of quantities items establish an adequate information base before the client initiates the quantifying of risk sources. However, the accuracy of bills of quantities depends very much on the amount of design information available. The domination of this method in traditional estimating techniques was illustrated by the exclusive use of bills quantities for budget prediction.

Finally, it is believed by the researcher that the bills of quantities method had the potential to quantify risk but that its accuracy level is low and needs to be improved to meet client expectations. The accuracy achievable was found to range between 5% and 10% but the information for producing such bills is lacking at project inception. The quantity surveyor has to wait for the project to reach post-tender stage to receive the increased amount of project information. The quantity surveyor could then potentially achieve a higher level of estimating accuracy, as expected by the client.

The quantity surveyor whose interview is described in Chapter 8 said that he had not been briefed on the intended changes at the inception of the community centre project. Security fencing and shelving for the intended community library were added during project execution. These design changes affected the original budget of KSh 5.26 million (about US$ 70 000), increasing it by 66 per cent during the construction period. For the secretariat and headquarters project, the contract sum amounted to KSh 16.3 million (about US$ 217 000). At the end of the contract the client for the secretariat and headquarters project paid KSh 21.7 million (about US$ 290 000) as the final project cost. The project thus exceeded its budgeted cost by 33 per cent.

The partitioning project was budgeted to cost KSh 11 million (about US$ 147 000), with the contract being based on approximate quantities that were subject to re-measurement on completion of the works. The final project cost was KSh 9.9 million (US$ 132 000) and was therefore 10 per cent lower than the original estimated cost. For the bank tower project, KSh 1.673 billion (about US$ 22.3 million) was the budgeted cost, though the contract sum amounted to KSh 1.695 billion (US$ 22.600 million) and the final building cost was KSh 1.6998 billion (US$ 22.664 million) – a less than 2 per cent increase on the original estimate. From the data collected from the case study projects, it was observed that the size of the project influenced risk assessment and evaluation. The level of accuracy achieved in estimated cost plans for large-scale projects was higher than in small projects – the bank tower project's being 2% over, as compared with the community centre project with a 66 % cost overrun.

The observation from the case studies was that accuracy in budget prediction is dependent on good cost data and consultant experience in foreseeing both design variations and changes in the client's requirements. The quantity surveyor should be able to anticipate changes and manipulate the cost plan accordingly. This corroborates similar findings of Kaming et al. (1997) on the expertise needed to plan costs accurately for risk in building projects.

The case study finding was that there is often a large disparity between the expected and the received accuracy levels in budget prediction, and that has can be reduced by well-defined pre-budget detailing, as seen in the bank tower project.

9.2.5 Cost impact risk in risk management

Seven cost-significant factors selected from 23 risk sources or factors were documented in Chapter 6. These were project size, project complexity, quality of design information, design variation, progress payment, political uncertainty and interest rate changes. According to the respondents, these seven risk factors and sources have high cost impacts and are worthy of consideration in budget prediction. Even then, the prioritisation of the major cost contributors is essential at the early project development stages.

The case study interviews in Chapter 8 produced evidence that supported the use of intuition/judgement/experience in risk analysis. The interviewees all believed that it was only through intuition, judgement and experience that they were able to assess future project risks.

Among the selected seven factors and sources of cost impact risk, five factors were deemed to be cost significant as shown by questionnaire respondents. The factors influencing cost impact assessment were size and complexity of the project, design variation, progress payment valuations and political uncertainty. The probability of occurrence of these five risk factors can not be determined by quantity surveyors given their lack of practice with probability theory and its applications.

The implication of current risk management strategies is therefore that avoidance and reduction of cost impacts generated by the size and complexity of a project is an important consideration in risk management.

In the literature on construction risk, authors such as Pender (2001) argue against the use of incomplete knowledge in cost and risk planning, and state that insufficient risk analysis in cost prediction makes budget prediction for risk management ineffective. These researchers advocate retaining risk and assessing its effect, to improve cost planning and risk management.

Most of the literature (e.g. Pender, 2001) on risk assessment focuses on quantitative estimating probabilities and probability distributions that do not lead to probabilistic methods of cost analysis. Kim and Bajaj (2000) found that Korean construction managers still use intuition, judgement and experience in risk management and cost impact assessments, which contradicts the theory presented in current quantitative estimating practices.

The researcher's finding regarding cost impact risk in risk management showed a contradiction between current practice and risk management theory. For example, the risk management literature has focused more on quantitative evaluation but current practice shows a form of qualitative evaluation using intuition/judgement/experience.

This finding concurs with the proposals of Tah and Carr (2000) for a shift in risk assessment to qualitative factors proactively generated from project information. Budget prediction depends on multiple qualitative factors whose cost impacts are difficult to assess. The researcher is of the opinion that ranking and prioritising the qualitative risk factors in building projects would simplify risk assessments and their cost impacts.

9.2.6 Frequency of occurrence risk in risk management

At feasibility stage decisions concerning cost are taken in advance to guide the client and the project. Consideration of size and complexity at feasibility stage is critical to budget prediction.

The case study interview results support the survey findings in Chapter 6. The interviewees identified design completeness, project complexity and quality of design information as frequently-occurring risks that significantly affect case budget prediction and risk planning.

At the inception and brief stage, risks from both the size and the complexity of a project usually occur frequently. These include the experience of the estimator, design completeness, quality of design information and brief uncertainty, which are deemed to be as important as financial risk indicators.

At the detail design stage of project development, frequency of risk occurrence sometimes originates from political uncertainty and from inflation and market conditions. Proactive anticipation of the risk frequency would therefore be beneficial to budget prediction at this stage.

The construction risk literature identifies the most important risk factors that frequently affect risk management. Akintoye (2000), Liu and Walker (1998) and Kaming et al. (1997) identified the complexity of the project and market conditions as significant risk factors, but these authors do not identify other risk factors that are mentioned in this study, such as design completeness, quality of design information, and brief uncertainty.

The implication of the identification of significant risks result was that at the feasibility and detail design stages the frequently-occurring risk factors that most affect budget prediction were the physical size and physical complexity of the project, political uncertainty, market conditions, design completeness, quality of design information, brief uncertainty and the experience of the estimator.

The researcher's survey of the literature shows that only three of the eight risk factors and sources have been identified to affect project planning. The remaining five risk sources and factors that have frequent occurrences in risk management in cost planning and control have hitherto not been actively considered in budget prediction. Thus a lack of consideration of major cost contributors to budget prediction has made risk management in cost planning and control relatively ineffective.

9.2.7 Response risk in risk management

Chapter 6 shows that a third of the respondents indicated that response to timely completion of final account risk occurred at tender stage. The three risk sources or factors of quality of design information, size and complexity of the project are responded to appropriately at tender stage because during early design development stages, future risk expenditures might not be clearly distinguished or thoroughly investigated. For example, interest rate changes, timely completion of the final account, and progress payment valuation are responded to at tender stage, which is too late for first budget information and therefore had to be proactively thought through at project inception. The assessment and the likely response to interest rate change risk, timely completion of final account and progress payment valuation was at tender stage.

Risks are suitably responded to at tender stage when the cost of the anticipated responses could be incorporated into budget prediction as early as at the feasibility stage. The opinion survey showed that the three risk factors of progress payment valuation, timely completion of final account and interest rate changes could only be responded to at tender stage when the amount of the project information had increased. The responses at feasibility and inception stages were therefore not supported by the respondents because they preferred retaining these at project inception and increasing the budget.

In Chapter 8, the bank tower project case study showed that retaining the risk and increasing the budget to cover for the anticipated risk was seen as a suitable response towards risk in such projects. The finding was not a surprise as it is consistent with the published literature, for example the study of Diekmann (1997). The project engineer was aware that the more information produced before the commencement of the project, the closer the budget prediction would be to the final building cost.

Cost advice and budget prediction are expected early in project development, and if the budget allocation is initiated at feasibility stage, then responses to the project complexity, the project size, and the quality of the design information can all occur at feasibility stage.

The risk management literature argues that risk has to be prioritised before budget increase responses are made but suggests the ranking of risk based on their contribution to budget cost impacts.

At the early project stages, time is very often insufficient for an extensive investigation to prioritise risk. Therefore the assignment of realistic information and priorities is necessary for risk management in cost planning and control practice. If no creative thinking is used, it is likely that risk assessment and management will be ineffective for budget prediction.

9.2.8 Assessment risk in the treatment of potential risk

The results show that some cost practitioners use the approximate quantities method to assess risks. For example, the majority of the quantity surveying firms said they used approximate quantities at tender stage to assess the final building cost.

Two thirds of all respondents expected the quantity surveyor to use intuition, judgement and experience in assigning risk allowances. Recalls of risk experience are used in this method of risk analysis. However, the subjectivity of risk recalls makes the intuition and judgement method somewhat unreliable, and lack of experience in large-scale risk management can render the technique prone to inaccurate budget prediction. The method also needs quality, updated and maintained data from previous projects. Where the data cannot be maintained or are inconsistent with the current price movements or trends, it becomes ineffective in risk assessment and management.

In Chapter 8, it is reported that the clients were likely to set up cost limits to guide the project designer at early stages. The interviewees were of the opinion that clients gave poor briefing at project inception. In the opinion of the interviewees, clients should be encouraged to demand more useful project information that could be used in financial risk assessment for ascertaining future project costs.

Most of the literature on risk management and cost planning (e.g. Uher, 1996 and Al-Momani, 1996) argues against the use of early bills of quantities information that is likely to be used in cost analysis; in its place they suggest the use of cost models to assess cost outcomes. However, Tah and

Carr (2000) argue that such techniques have failed to meet the client cost objectives because project details that could be used to assess and sum up the cost are not available when budget prediction is needed.

The research results regarding assessment risk in the treatment of potential risk showed that respondents believed that the quantity surveyor should formulate an alternative method of risk assessment, incorporating risks in cost and risk planning before building commences.

9.2.9 Communication risk in the treatment of potential risk

Chapter 6 showed that less than half of the respondents communicate risk proactively, and one third reported that they always communicate risk reactively on request.

The highly fragmented nature of the construction industry causes a lack of motivation to give out project information. This prevents or inhibits communication of anticipated risks, whereas proactive communication would contribute significantly towards initiating discussions for better project understanding.

Reactive communication limits risk investigation, as there is a lack of time to explore alternative sources of risk. In addition, the amount of information available for risk analysis and assessment is likely to be inadequate. Furthermore, inadequate information made available to the cost advisers at project inception further complicates the risk identification, assessment and evaluation process.

Limitations due to lack of risk experience, lack of project information and the motivation to find the time to investigate expected accuracy, cause financial risk, particularly at the early development stages. These limitations would be greatly lessened if proactive risk identification, assessment and evaluation were undertaken at inception stage, or would be avoided or reduced if effective proactive communication could be encouraged in the budget prediction environment.

Cost predictions and the respondents' reactions to risk management and cost planning were shown in the research to vary at different project stages. Clients do not request risk and cost management services. There is a lack of awareness of the benefits of proactive communication on project management, risk and cost planning.

The case study interview finding was that risk problems were only occasionally communicated, thus supporting the results established in the literature (see Hegazy and Moselhi, 1995).

The research findings showed that there is a limited exchange of information between clients, architectural and quantity surveying firms. Reactive communication highlights the need to improve current practices through innovation and creativity. The communication of specific project information, produced using specific and detailed cost information, would suit generalised project risk assessment. However, the flexible cost plans produced with temporary management structures in building projects was ineffective in communicating building risks and anticipated outcomes.

9.2.10 Some selected findings from the questionnaire survey

The following practices were found in the questionnaire survey to expose the client to financial risk thus supporting the research hypothesis that states that risk management functions has been ineffective

- The bills of quantities technique was the dominant estimating method in cost planning and control.
- The intuition/judgement/experience method was the tool most widely used in risk assessment and evaluation in risk management.
- The major risk factors were the exclusive use of bills of quantities, intuition/ judgement/experience, size of the project, complexity of the project, completeness of design, and market and tender conditions.

9.2.11 Findings from the case-study interviews

In the case study interviews it was found that clients are exposed to financial risk due to the ineffective practices adopted by the respondents when dealing with building risks. For example, Chapter 8 reported that in the three case studies there was almost no explicit mention of quantifying risk.

The ineffective risk management and cost planning practices found in the case studies included:

Cost analysis procedures used in budget prediction were ineffective in small projects and more effective in large projects.

The interviewees had attempted to improve building risk management practices in their projects by managing financial risks by qualitative methods. The cost plans reflected the anticipated risks – by planned risk allowances and by increasing the risk budget to cover unexpected costs.

The three main interviewees concurred on the risk factors that were most important in budget prediction: the complexity of the project, the quality of design information, the experience of the consultant, and the completeness of the design. Similarities in approach to significant risk factors in risk quantification and assessment were documented in risk management, but the budget prediction responses to those risks differed, whether in mitigating, reducing or avoiding risk. Retaining the risk and increasing the budget was the preferred alternative. All three interviewees were not familiar with conventional risk-analysis methods for quantifying and assessing risk, or for the reduction or mitigation of risk.

The overall findings on risk management practice drawn from the interviewees on case-study A, B and C projects, exposed the client to financial risk in building projects. The revealed practices included

- The limited formal risk management applied to budget prediction.
- The interviewees thought that the most important risk factors to be considered in risk management at the budget prediction stage were quality of design information, brief uncertainty, completeness of design, and conditions of contract.
- The interviewees relied on retaining risks and increasing the budget rather than on any other risk response technique.

The above evidence showed that the risk management and cost planning practices offered by the quantity surveying firms was ineffective in risk assessment, thus supporting the research hypothesis.

9. 2.12 Summary of the empirical results

Table 9.1 summarises the empirical results emanating from the questionnaire survey and case study interviews.

Table 9.1 Summary of the empirical results

Section theme	Questionnaire survey	Case study interviews
Demographics and data of the research subjects.	Experience with large scale construction projects is lacking in the practice of research subjects.	Risk management experience is gained internally without involving a thorough project risk investigation.
The practice of cost planning and control in Kenya.	Bills of quantities is the preferred means of assessing risk in cost planning and contract documentation.	The approximate quantities were used in assessing cost plans.

Table 9.1 (continued) summary of the empirical findings

Section theme	Questionnaire survey	Case study interviews
The nature and extent of risk management performed by the quantity surveyor in Kenya.	Seven risk factors or sources were found: size and complexity of project, quality of design information, design variation, progress payment, political uncertainty and interest rate changes.	The critical risk factors that affect cost planning were complexity of project, quality of design information and experience of the consultant.
The treatment of potential risk in cost planning and control in Kenya.	Quantity surveying firms reported using the approximate quantities method. The quantity surveyor was expected to use the intuition, judgement and experience method for risk analysis.	Interviewees relied on retaining risks and increasing budget rather than any other risk response technique.

9.3 Synthesis of results for risk management, cost planning and control practices

The aim of this section is to draw together significant findings of the opinion survey and the case study interviews that affected risk management and cost planning and control thus exposing the client to financial risk in building projects. The identified risk indicators derived from this synthesis can be used as a conceptual framework for an appropriate risk management system of important groups or clusters of risk indicators applicable to cost planning and control practices.

The main research problem under investigation is that in construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget. The risk exposures should be identified and determined by the professional building cost consultant. The research has found that there is a gap in local knowledge of the characteristics of building risk for them to be assessed effectively during risk management and cost planning.

Risk indicators were found to be important to risk management in cost planning and control of building projects. The researcher advocates the use of proactively derived risk indicators that could simplify risk management in cost planning and control practice. At the same time proactive risk indictors would represent groups of risks, or risk clusters of similar sources, which can affect budget prediction risks and their outcomes. The risk indicators described below have been observed and synthesised in the study as risk indicators that have some influence on budget prediction and risk management.

The results of the empirical analysis show that the following issues are pertinent to the risk management functions of quantity surveyors:

- Records of previous cost data and market trends should be maintained for use in forecasting future projects in Kenya.
- The bills of quantities used in cost prediction should be open for checking, budget adjustment and addendum – for future cost variations and design changes.
- Construction budget should take into consideration the size and complexity of the projects set at project inception, as the application of formal risk analysis to construction projects is limited.
- Intuition, judgement and experience techniques of risk assessment should be improved by further case studies of specific projects in order to understand the behaviour and characteristics of risk management in cost planning and control.

If the above practice suggestions are considered; more effective risk assessment might result thereby reducing risk exposures of the client in construction projects.

9.4 Conclusions

This chapter has discussed results obtained from the opinion survey questionnaire and the case study interviews. It is apparent that there is a need for the Kenyan quantity surveyor to provide effective service on cost advice. However, lack of project information, lack of exposure to high-risk projects and ineffective communication of project risk cause poor budget prediction.

The survey reveals that traditional estimating methods in Kenya are mainly used for cost planning purposes rather than for risk management and budget prediction.

Project budget prediction goes wrong because the risks specific to a project are not identified, assessed and evaluated. This failure prevents appropriate budget increases from being allocated to risk outcomes.

Lack of quality project information such as the bills of quantities and the risk assessment methods adopted through intuition/judgement/experience contributes to poor budget prediction. The need to improve on inadequate information and the presence of incomplete drawings led cost advisers to use assumptions and creativity with gathered information that has caused unreliable production of building budgets. The cost adviser should therefore demand more project information for budget prediction.

Improvement on limited project information about a future project can be facilitated by proactive creative thinking, in an attempt to establish likely information requirements at detail design stage rather than depending on the insufficient information that is made available at early stages of the project.

The following final chapter documents the conclusions and recommendations.

CHAPTER 10

Conclusions and Recommendations

10.1 Introduction

This study evaluates building projects risk management in cost planning and control in Kenya. It has documented the nature and extent of cost planning and risk management offered by the quantity surveyor in the Kenya building sector. It has focused on the assessment, quantifying and management of risk on building projects.

The research problem was stated (Chapter 1) as:

In construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget, as determined by the professional building cost consultant.

Chapters 2, 3 and 4 provided a focus for the investigation of the research questions, namely:

(a) What are risk indicators and risk management? What is the existing gap in risk management knowledge?

(b) What are the financial risk indicators?

(c) What are the sources of risk in a building project and how can they be identified to aid budget prediction?

The hypothesis tested by the research is that:

The risk management function as exercised by the professional building cost consultant in cost planning and control of building projects is usually ineffective.

The methodology chosen for the research was largely ethnographic, comprising discursive review of appropriate literature, questionnaire survey and case study interviews, using a qualitative, rather than a quantitative approach.

In this chapter, the findings of the research questions are presented; followed by a review of the hypothesis formulated for the research. Conclusions are drawn from the research findings, and recommendations made for future research and for practice. Finally, the attainment of the research objectives is discussed.

10.2 Validation of research problem

The research problem was validated by the questionnaire surveys and case studies interviews. More specifically it was shown that:

- The vast majority of building projects undertaken in Kenya exceed the agreed budget amount.
- Cost planning and control as practiced by quantity surveyors in Kenya is reactive rather than proactive
- Risk management is not an integral part of cost planning and control

10.3 Findings of the research questions

This section presents the findings of the research questions.

(a) What are risk indicators and risk management? What is the gap in risk management knowledge?

(a)(i) What are risk indicators and risk management?

The preferred definition of *risk* was argued in Chapter 2 and found to be that " *Risk is an exposure to financial cost impacts, arising from involvement in the construction process where cost variations result in uncertainty in forecasting building cost*". Thus risk has a cost component as well as a management component, and the quantity surveyor is expected to undertake risk assessment in building estimates when offering quantity surveying services to the building client.

Uncertainty has been described as a relative lack of certainty about information relating to a building event and in particular cost uncertainty is a state of incomplete knowledge about a financial variable (Chapter 2). The total sum of cost uncertainty is a collection of factors contributing to the cost forecasting problem. Thus "*Uncertainty is the variability of future cost and financial outcomes where probabilities distributions cannot be constructed*".

Risk management is the systematic application of financial planning, monitoring and controlling of risks in building projects (Chapter 2). Procedurally, the gathering and interpreting information is done to influence response actions as a deliberate attempt to influence financial outcomes in building projects.

Risk Management strategies are the systematic approaches that deal with risk problems (Chapter2). Suitable projects are designed with risk resolution in mind and risk management strategy can aid in the control of building risk that becomes apparent soon after project inception. Two risk management strategies were found to be appropriate for consideration by the quantity surveyor; risk clustering and indicators.

Risk profiles and clusters may be described as groups of risk with related outcomes and with similar characteristics (Chapter 2). Risks grouped together for their similarity of outcomes or relations can more easily be understood and effectively evaluated. The significant clusters crucial to risk management of building projects were found to be:

- Cluster 1. Budgeting process, estimating, forecasting and budget variability risks
- Cluster 2. Quantification, uncertain variables, client diversity and accuracy expectations risks
- Cluster 3. Physical characteristics of the building, market characteristics and contract and procurement system risks

Risk indicators reflect risk outcomes that can easily be classified as all risks are recognised through risk events or cause-effect characteristics. A risk indicator is defined as: "*Risk indicator is an abstraction of the lack of predictability of a risk factor*". The event causing the risk can be controlled if the source is determined in time. Distinguishing risk indicators proactively might lend to identification and risk analysis that effectively controls financially adverse events by planning for them in advance. The list of risk indicators important to budget prediction and risk management would be the bills of quantities method of estimating, design completeness, intuition /judgement / experience risk analysis method, physical characteristics of the project and the market conditions.

(a)(ii) What is the existing gap in risk management knowledge?

The research has identified some shortcomings of quantity surveying practices in Kenya that reflect a gap in risk management knowledge (Chapter 1).

In Kenya, the holistic cost advice required by clients at early project stage focuses attention on the final building cost, but there remains no explicit in practice of risk indicators affecting risk management, although the latter is undoubtedly affected by risk assessment. Managerial and human risk indicators, which influence the effectiveness of early stage building budgets, are missing in practice from developing countries like Kenya, and where they are provided, they are almost always inadequate for investigating future project cost assessments.

The Kenyan practice literature available to quantity surveyors is significantly silent on risk management in cost planning and cost control.

Cost information should be specific if it is to be of use for budget prediction. Project-specific information is lacking in quantity surveying practice in Kenya, particularly regarding insights gained from client knowledge and experience. Consequently findings have been generalised to facilitate budget formulation without details of specific projects. Cost information, particularly in a developing building industry like Kenya's, would broaden the risk management and cost planning and control knowledge base by extending the existing boundaries of risk experiences to developing building markets where the client's project assessment and cost evaluation has not been studied before.

(b) What are the financial risk indictors?

Chapter 3 documented risk factors and indicators that would be of use to organisations in the evaluation, selection or development of a risk management method. Risk pointers would aid risk assessment by identifying financial risk indicators in advance that might help in situations where the clients are exposed to financial risk as a result of final building costs exceeding the budget.

Project size and the amount of information available were found to influence risk management in cost planning. Risk management, when practised, is not done integral to cost planning and cost control, thus affecting the quantity surveyor's ability to manage building cost.

The results of the study showed that the risk management function as exercised by the professional building cost consultant in cost planning and control of building projects is likely to be ineffective due to late checking of cost plans by both the project quantity surveying firm and the client, which was found to be executed at the detail design and tender stages, respectively.

(c) What are the sources of risk in a building project and how can they be identified to help budget prediction?

Chapter 4 provides a summary of risk identification and measurement, and depicted risk knowledge as the basis for identifying and treating risk indicators. Risk identification represents the first step in reducing uncertainty and determining potential risk indicators. This section also noted that poor budgets were rooted in inadequate front-end planning at the early stage and that the owner's influence over a project is greatest at that stage, when the probability of the event happening can be controlled.

The following factors reflect the absence of important risk indicators in the current practices that affect the effectiveness of budget prediction offered by quantity surveying practices:

- Lack of experience in risk management
- Lack of project-specific information
- The poor quality of bills of quantities
- The inadequate assessment and evaluation of cost impacts
- The ineffective treatment of potential risks arising from the project.

The evidence supported the research proposal' that in construction projects, clients are exposed to financial risk as a result of final building costs exceeding the budget, as determined by the professional building cost consultant.

In terms of current building project risk management, the questionnaire survey results showed that:

- *Cost planning and cost control practised by quantity surveyors in Kenya is reactive.*

- *The bills of quantities method was the preferred and dominant technique in the treatment of potential risks, although the effectiveness of cost planning was compromised where quantity surveyors used approximate quantities to assess building risks.*

- *Cost planning and cost control procedures, when applied, are administered too late in the procurement process.*

- *Client briefing is generally inadequate in terms of providing foci for financial risk management.*

- *The intuition / judgement / experience method of risk analysis was the only one used to identify and quantify risk impacts during risk management in budget prediction.*

- *The most important risk factors to be considered in risk management with budget prediction were the quality of design information, brief uncertainty, completeness of design and conditions of contract.*

- *Budgets did not deal consistently or comprehensively with impact, magnitude or the temporal dimensions of risk exposure.*

- *Budget prediction focused on risk impacts but not on the risk event itself or its cost magnitude*

- *Budget prediction was informally and implicitly carried out without the input of various building participants.*

- *The nature and extent of the services offered by the quantity surveyor in risk management and cost planning and control were not integrated and were applied separately in the treatment of potential risk. Risk management needs to be integrated into traditional cost planning procedures to increase the efficacy of budget prediction.*

The case study interviews revealed, in addition to the findings emanating from the questionnaire survey, that:

- *Interviewees were not familiar with the process of quantitative risk analysis techniques.*

- *Interviewees relied on the retaining and increasing of the budget rather than on any other risk management technique.*

- *Limited formal risk management was observed in budget prediction and none of the participants quantified risk in their risk management process.*

- *There was little or no evidence of project risk monitoring or control in the budget prediction process.*

10.4 The research hypothesis

The research has tested the hypothesis that the risk management function as exercised by the professional building cost consultant in Kenya in cost planning and control of building projects could be improved. The hypothesis was explored through the literature review, opinion survey and case study interviews (Chapters 2, 3, 4 and 6, 8, 9).

The empirical findings of chapter 6, 8 and 9 showed that hypothesis is supported in a general sense by the current practices of quantity surveyors in Kenya. The research hypothesis that the risk management function as exercised by the professional building cost consultant in cost planning and control of building projects could be improved is also supported by the research finding for the following three reasons.

- Risk management in cost planning and control has been affected by unpredictable factors such as changes in design, management and technical features. The heterogeneity and scale of the project make these factors difficult to define for assessment purposes. As a result, the professional building cost consultant often resorts to creativity and innovation based on qualitative variables that are known to cause cost impacts in similar types of projects.
- The use of intuition/judgement/experience to support budget prediction with the bills of quantities method was limited. The cost adviser needs to focus on the size and complexity of the project.
- The use of proactive risk indicators to manage anticipated risks in budget prediction, and the grouping of anticipated risks into clusters and broad risk subsets, facilitated the development of risk indicators for effective risk management and better risk management in the cost planning and control of building projects.

From the discussion presented in the research the thesis was supported by the findings in the study.

This evidence supports of the research hypothesis that in construction projects, clients are exposed to financial risk as a result of building costs exceeding the budget, as determined by the quantity surveyor in Kenya.

10.5 Conclusions

The research has shown that the risk management and budget prediction practices offered by quantity surveying firms in Kenya are generally ineffective. Much is left to the intuition judgement / experience of the quantity surveyor who has not been given the tools to assess and evaluate building risk within the time allocated before the building commences. The inadequate project information provided at the early project development stages acts as a limitation to the proactive development of cost planning and risk management practices.

The probabilistic and proactive creation of project information is ignored, in favour of the limited and scarce project information derived from the historical data of similar previous projects which influences the assessment and evaluation of building risk in both the budget prediction and in risk management procedures.

The absence of risk indicators in risk assessment, budget prediction and risk management procedures demands an effective evaluation of building risk in order to guide the quantity surveyor to managing final building costs. Professional judgement attained through professional education, training and learned skills through exposures to building risk is not adequate to prepare future quantity surveyors to risk assessment and managing final building cost where unusual risk events are likely to occur in building projects.

10.6 Recommendations

Future research effort might be directed towards developing guidelines to simply risk management in cost planning and control. The study calls for proactive risk identification, assessment and evaluation, and recommends that financial risk management be viewed as an integral part of cost planning and control during the budget prediction of building projects.

More detailed briefing and communication that should include costs and clients expectations. Standardised ways of financial planning that can be applied more effectively to public and private investment projects need to be developed so that governments could be able to control their development expenditures

The researcher recommends that tertiary curricula for the professional quantity surveyor in Kenya should expose students to more risk management concepts and practices. Further, professions associated with the construction industry should include the topics of risk and financial risk planning in their continuing education and training for their career development programmes. Given the development of such recommended practices in the theory of risk management in cost planning and control, budget prediction potential would be realised to facilitate the timely identification and response to potential budget overruns in the Kenyan building industry.

Attention of future research should focus on the risk management practices of other industries such as the insurance and investment sectors; drawing on the lessons learned or practices applied there to manage risk and risk consequences.

10.7 Achievement of the research objectives

The objectives for the research were:

- *to identify the current practice of cost planning and control of building projects employed by professional building cost consultant firms in Kenya;*
- *to identify the risk characteristics of construction projects and the risk management techniques employed by professional building cost consultants in the cost planning and control of building projects;*
- *to evaluate the efficiency of traditional cost planning procedures with special reference to adequate identification of their sources, thus enabling a positive response to the adverse risk conditions that create construction cost excesses and cause final construction costs to exceed defined budgets;*
- *to examine the benefits that could be derived from a properly formulated risk management system within the context of the cost planning and control of construction projects;*
- *to develop recommendations for changing cost planning and control procedures, so as to accommodate the risk management function in the cost planning and control of building projects. This should facilitate timely identification of, and response to, potential budget overruns.*

The first and second objectives have been achieved through the discursive literature review of risk and risk management undertaken in Chapter 2, 3 and 4 of this thesis. Risk, risk management and uncertainty have been more clearly defined. Risk profiles and clusters have been classified in the context for risk management of building projects in Kenya.

The third and fourth objectives were achieved through the conclusions drawn from the analysis and findings drawn from the primary data collection as reported in Chapters 6 and 8 of this thesis.

Examination of cost planning and control and risk management perceptions of quantity surveyors and other construction industry professionals has been undertaken and the limitations of practices offered by the quantity surveyor in current practices of risk management in cost planning and control have been explored and discussed in Chapter 9.

The fifth objective of this research was to develop recommendations for improving cost planning and control and risk management procedures for building projects in Kenya and this has been facilitated in Chapter 10 of this thesis.

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APPENDIX 1

Variables in the questionnaire survey

Section	Research questions	Item on survey
1.Demographics	Questions 1.1 to 1.8	Spread; staff establishment; experience; gross turnover; workload; procurement method; documentation type in project costing.
2. Cost planning and control	Questions 2.1 to 2.13	Time of appointment; methods of estimating; type of rates used; current practices of cost planning; budgeting and first cost plan; checking cost plans; expected accuracy levels in estimates; risk indicators.
3. Risk management	Questions 3.1 to 3.3	Risk factors and sources; frequency of risk occurrence; impact on building cost budget; recommended response to risk factors and sources.
4. Treatment of potential risks	Questions 4.1 to 4.6	Familiarity with risk management theory; risk management experience; potential of traditional methods of incorporating risk into budget; risk analysis techniques; use of risk analysis; factors influencing applications of risk evaluation; communication of budget implications of risk.

Questions used in the case study interviews and their rationale

Question	Reason
How do you use different price data with the different estimating methods to compile the final building estimate (cost budget)?	Testing the participants' knowledge and experience with price data sources, particularly when identifying potential data-source risk indicators.
How accurate is quantity surveyors' cost advice?	Testing participants' knowledge of budget accuracy experience when identifying potential risk indicators.
What is your assessment of the potentials of risk analysis techniques when assessing the risk component of a building budget?	Testing participants' knowledge with risk analysis techniques, and their experience in identifying potential risk indicators.
How would you implement risk analysis techniques to assess risks in building projects?	Testing participants' knowledge regarding implementation of cost assessment experience and in identifying potential risk indicators.
How do you deal with cost impacts on the estimated cost plan (budget) if they were to occur?	Comparing the actual risk management process with risk indicators from the literature, and identifying recommendations for clustering risk sources for risk management.
What are the most frequent risk factors or sources occurring during cost budget assessment?	Exploring risk quantification and risk assessment knowledge, with the aim of prioritising risk sources and factors for risk management.
How do you respond to risk at the budgeting assessment stage of a project?	Establishing participants' risk identification processes for controlling outcomes and setting risk subsets of broad risk entities; based on similar risk responses for risk management.
How do you manage risks in budget?	Establishing levels of risk management knowledge in budget prediction for the development of recommendations that accommodate risk impact in cost planning and control.
How do you communicate the following likely cost impacts in the budget? (See Appendix 2) How do you warn the client on budget consequences and uncertainty?	Establishing participants' risk communication processes and identifying methods for recommending potential risk management actions.
In your own assessment, what are the problems in the building cost budget, as defined and predetermined by the quantity surveyor?	Seeking reasons for non-usage of risk management and eliciting suggestions for improvement.

APPENDIX 2

SAMPLE COPY OF SURVEY QUESTIONNAIRE (QS)

QUESTIONNAIRE FOR QUANTITY SURVEYOR

SECTION ONE: DEMOGRAPHIC DATA

In this section you are requested to fill in details about your working environment. The information provided will only be used to identify and define the participants profile and to assist in data interpretation. Kindly place an "X" in the appropriate spaces provided.

1.1 Which geographic area is your firm is situated?

Nairobi	Mt.Kenya	Coast	Western	Nyanza	South Rift	North Rift	Northern Districts

1.2 Please indicate the number of staff (according to category) in your organisation.

	0-5	6-10	11-25	26-50	>50	Others (specify)
Number of persons						

1.3 Please indicate your number of years of working experience in the construction industry.

Years of experience	0-5	6-10	11-15	16-20	>21

1.4 Please indicate the firm's average gross annual turnover, in respect of building value, over the last 5 years.

KShs in Millions	<2	2.1-5.0	5.1-10	10.1-25	25.1-50	50.1-100	100.1-150	>150.1

1.5 Please indicate the value of your current public and private workload as a percentage of your total work value (Total of all cells to equal 100%).

	Public sector	Private sector
Housing		
Industrial		
Commercial		
Engineering		
Renovation & Maintenance		
Others (please specify)		

1.6 Please indicate which contract procurement methods you have been involved in over the past three years.

	percentage of total
Open tender	
Selected tender	
Negotiated contract	
Other (please specify)	

1.7 What type of documentation have you used in the contract procurement process over the past three years?

	percentage of total
Bills of quantities	
Provisional bills	
Schedules of rates	
Other (please specify)	

SECTION TWO: COST PLANNING AND CONTROL

The following questions are intended to identify the current estimating methods and the practice of cost planning and control as applied by you on real projects.

2.1 Indicate the stage at which you, the quantity surveyor, initially become involved in the project.

	always or frequently	occasionally	seldom or never	n / a
Inception and brief				
Feasibility				
Sketch design				
Detail design				
Tender				

2.2 What method do you use to provide an estimate of final building cost?

	Always or frequently	occasionally	seldom or never	don't know
Functional unit				
Superficial				
Approximate quantities				
Elemental				
Bill of quantities				
Other (please specify)				

2.3 Which, if any, of the following factors influence the method of estimating that you use?

	always or frequently	occasionally	seldom or never	don't know
Size of project				
Client requirements				
Time available				
Amount of information available				
Other (please specify)				

2.4 Which of the following estimating methods does your office normally use during the various stages of a project?

	inception & brief	feasibility	sketch design	detail design	tender
Functional unit					
Superficial					
Approximate quantities					
Elemental					
Bill of quantities					
Other (please specify)					

2.5 What method do you use to determine the rates used to compile the estimates?

	Functional unit	Superficial	Approximate quantities	Elemental	Bills of quantities	Other (specify)
Rates from previous, similar projects are suitably updated for inflation, site, market and conditions						
Price books (e.g. Spon's price book , etc)						
'Gut-feel' rates based on previous projects and experience						
Rates are calculated for each new project from first principles						
A library of rates kept from each previous project is put into a form which can be used for future projects						
Other (please specify)						

2.6 The following questions are intended to identify the current practice of cost planning and control

	YES	NO	N/A
Do you set up a cost plan to control cost on projects			
As part of the cost plan do you establish a cost limit with the client			
Which of the following cost planning systems do you use?			
Elemental cost planning system (designing to cost)			
Comparative cost planning system(costing a design)			
If other (please elaborate)			

2.7 At what stage of the project do you first establish the budget for the client?

	always or frequently	occasionally	seldom or never	don't know
Inception and brief				
Feasibility				
Sketch design				
Detail design				
Tender				

2.8 At what stage of the project do you produce the first cost plan?

	always or frequently	occasionally	seldom or never	don't know
Inception and brief				
Feasibility				
Sketch design				
Detail design				
Tender				

2.9 Do you check the estimated cost against the cost plan (cost budget estimate) at the different stages?

	always or frequently	occasionally	seldom or never	n /a
Inception and brief				
Feasibility				
Sketch design				
Detail design				
Tender				

2.10 If cost planning and cost control advice is not given, do any of the following reasons apply?

	always or frequently	occasionally	seldom or never	don't know
Lack of time				
Lack of expertise				
Not financially viable				
Not requested				
Not in the scale of fees as a basic service				
Size of project				
Other (please specify)				

2.11 Please indicate your perception regarding the accuracy of methods used in providing the estimate of final building cost. (E.g., within 5% range).

	within 5%	within 10%	within 15%	within 20%	within 25%	Within 30%	above 30%	don't know
Functional unit								
Superficial								
Approximate quantities								
Elemental								
Bills of quantities								
Other (please specify)								

2.12 What are the expected accuracy levels of your estimates at the various stages of the project listed below, relative to the accepted tender?

	Within 5%	Within 10%	Within 15%	Within 20%	Within 25%	Within 30%	Above 30%	don't know
Inception and brief								
Feasibility								
Sketch design								
Detail design								
Tender								
Post-tender								

2.13 Please indicate upon which of the following factors listed below, if any, does the accuracy of the estimate depend?

	Always or frequently	occasionally	Seldom or never	don't know
Estimating expertise				
Good cost data base				
Amount of design information available				
Suitability of estimating method at different stages of the project				
Chance				
Method used				
Other (please specify)				

SECTION THREE: RISK MANAGEMENT.

Rank on a scale of 1-5, your assessment of risk frequency, impact and the typical response of the listed risk sources / factors as applied by you to real projects.
For each factor, fill in your assessment as indicated in each question.

		Q.3.1 Indicate the frequency with which the listed risk sources are relevant during the different stages of the project.						Q 3.2 Indicate the cost impact on the estimated cost plan (budget) of the listed risk sources / factors if they were to occur.					
Risk factors and sources		inception & brief	feasibility	sketch design	design detail	tender		inception & brief	feasibility	sketch design	design detail	tender	
Contract	Size of project												
Contract	Complexity of project												
Contract	Location of project												
Contract	Conditions of contract												
Contract	Type of procurement system												
Client / Professional	Quality of design information												

		Design completeness												
		Type of client												
		Design variations												
		Brief uncertainty												
Estimating	Pre-tender	Expertise of estimator												
		Quality of estimating data												
		Type of estimate												
		Experience of estimator												
	Post-Tender	Timeous cost reports												
		Timeous completion of final account												
		Accurate progress payment valuations												
Project risks		Natural events (e.g. earthquakes)												
		Floods												
External factors		Inflation and market conditions/Tender conditions												
		Political uncertainties												
		Interest rate changes												
		Contract period overruns												

SECTION FOUR: TREATMENT OF POTENTIAL RISK

The intention of the following questions is to explore your opinions about the potential risk management techniques that may be applied by you during cost planning and control of building projects.

How familiar are you with the theory and practice of risk management?

(a) Familiar with the theory	Yes		No	
(b) Experienced in practice.	Yes		No	

4.2 What is your assessment of the potential of the estimating methods listed below to incorporate allowances for risk?

	good	acceptable	poor	don't know
Functional unit				
Superficial				
Approximate quantities				
Elemental				
Bills of quantities				
Other (please specify)				

4.3 Do you use any of the following risk analysis techniques for assessing the risk component of the final building cost?

	always or frequently	occasionally	seldom or never	don't know
Intuition/judgement / experience				
Sensitivity analysis				
Probability analysis				
Monte Carlo simulation				
Decision trees analysis				
Utility theory analysis				
Other(please specify)				

4.4 At what stages of the project would you implement the techniques listed below in risk analysis?

	inception & brief	feasibility	sketch design	detail design	tender	don't know
Intuition/judgement/ experience						
Sensitivity analysis						
Probability analysis						
Monte Carlo simulation						
Decision trees analysis						
Utility theory analysis						
Other(please specify)						

4.5 Do any of the factors listed below influence whether or not you apply risk evaluation techniques in cost planning?

	always or frequently	occasionally	seldom or never	don't know
Lack of time				
Lack of expertise				
Not financially viable				
Not requested				
Size of project				
Not in the schedule of basic services				
Other (please specify)				

4.6 Is the extent of risk in the budget communicated to the client by you during the various post-contract stages?

	always or frequently	occasionally	seldom or never	don't know
Reactively on request				
Proactively before requested				
Other (specify)				

APPENDIX 3

SAMPLE SUMMARY OF QUESTIONNAIRE RESPONSES

QUESTIONNAIRE FOR THE QUANTITY SURVEYORS

Kindly place an "X" or a "TICK" in the appropriate spaces provided.

SECTION ONE: DEMOGRAPHIC DATA

In this section you are requested to fill in details about your working environment. The information provided will only be used to identify and define the participants profile and to assist in data interpretation.

1.1 Which geographic area is your firm is situated?(tick more than one area if your firm has branches in different regions of Kenya)										
Nairobi	Mt.Kenya	Coast	Western	Nyanza	South Rift	North Rift	Northern Districts	Academic (specify)	Other (specify)	missing
38(82.6 %)	4(8.69%)									4(8.61%)

1.2 Please indicate the number of staff (according to category) in your organisation							
	0-5	6-10	11-25	26-50	>50	Others (specify)	missing
Number of persons	28	8	4	0	1	0	5(10.86%)

1.3 Please indicate your number of years of working experience in the construction industry.						
Years of experience	0-5	6-10	11-15	16-20	>21	missing
	9(19.56%)	5(10.87%)	0(0.0%)	5(10.87%)	23(50.00%)	4(8.60%)

1.4 Please indicate the firm's average gross annual turnover, in respect of building value, over the last 5 years.								
KShs in Million s	<2	2.1-5.0	5.1-10	10.1-25	25.1-50	50.1-100	100.1-150	>150.1	missing
	2(4.35%)	4(8.69%)	4(8.69%)	9(19.57%)	9(19.57%)	4(8.69%)	4(8.69%)	5(10.87%)	5(10.87%)

1.5 Please indicate the value of your current public and private workload as a percentage of your total work value (Total of all cells to equal 100%).		
	Percentage of workload	Missing
Housing	34(73.80%)	12(26.08%)
Industrial	12(26.00%)	34(73.92%)
Commercial	23(50.00%)	23(50.00%)
Engineering	7(15.00%)	39(84.78%)
Renovation & Maintenance	22(47.81%)	24(52.17%)
Others (please specify)	9(19.55%)	37(80.44%)

1.6 Please indicate which contract procurement methods you have been involved in over the past three years.		
	percentage of total	missing
Open tender	29(63.o2%)	17(36.96%)
Selected tender	36(78.25%)	10(21.74%)
Negotiated contract	24(52.16%)	22(47.83%)
Other (please specify)		

1.7 What type of documentation have you used in the contract procurement process over the past three years?		
	percentage of total	missing
Bills of quantities	40(86.95%)	6(13.04%)
Provisional bills	17(36.94%)	27(63.04%)
Schedules of rates	17(36.94%)	29(63.04%)
Other (please specify)	3(6.51%)	43(93.47%)

SECTION TWO: COST PLANNING AND CONTROL

The following questions are intended to identify the current estimating methods and the practice of cost planning and control as applied by you on real projects.

2.1 Indicate the stage at which you, the quantity surveyor, initially become involved in the project.(tick all stages as appropriate)

	always or frequently	occasionally	seldom or never	n / applicable	missing
Inception and brief	14(30.43%)	18(39.13%)	4(8.69%)	5(10.87%)	5(10.87%)
Feasibility	9(19.57%)	20(43.48%)	7(15.22%)	5(10.87%)	5(10.87%)
Sketch design	15(32.61%)	15(32.61%)	7(15.22%)	4(8.69%)	5(10.87%)
Detail design	17(36.96%)	10(21.74%)	5(10.87%)	5(10.87%)	5(10.87%)
Tender	15(32.61%)	3(6.59%)	14(30.44%)	9(19.51%)	5(10.87%)

2.2 What method do you use to provide an estimate of final building cost?(tick all methods as appropriate)

	Always or frequently	occasionally	seldom or never	don't know	missing
Functional unit	3(6.52%)	9(19.56%)	21(45.65%)	9(19.56%)	4(8.69%)
Superficial	3(6.52%)	9(19.56%)	21(45.65%)	9(19.56%)	4(8.69%)
Approximate quantities	23(50.00%)	14(30.43%)	1(2.17%)	4(8.69%)	4(8.69%)
Elemental	17(36.96%)	11(23.41%)	7(15.22%)	7(15.22%)	4(8.69%)
Bill of quantities	27(58.69%)	4(8.69%)	4(8.69%)	7(15.22%)	4(8.69%)
Other (please specify)					

2.3 Which, if any, of the following factors influence the method of estimating that you use?(tick all factors as appropriate)

	always or frequently	occasionally	seldom or never	don't know	missing
Size of project	25(54.25%)	6(13.04%)	5(10.87%)	6(13.04%)	4(8.69%)
Client requirements	15(32.62%)	17(36.96%)	3(6.52%)	7(15.21%)	4(8.69%)
Time available	20(43.48%)	12(26.08%)	4(8.69%)	6(13.04%)	4(8.69%)
Amount of information available	37(80.43%)	3(6.53%)	0(0.0%)	2(4.35%)	4(8.69%)
Other (please specify)	6(13.04%)	2(4.35%)	1(2.17%)	33(71.74%)	4(8.69%)

2.4 Which of the following estimating methods does your office normally use during the various stages of a project?(tick all methods as appropriate)

	inception & brief	feasibility	sketch design	detail design	tender	missing
Functional unit	1(2.17%)	0(0.00%)	2(4.35%)	0(0.0%)	27(58.69%)	16(34.78%)
Superficial	1(2.17%)	6(13.04%)	1(2.17%)	23(50.00%)	8(17.39%)	7(15.21%)
Approximate quantities	2(4.35%)	0(0.0%)	0(0.0%)	7(15.22%)	31(67.39%)	6(13.04%)
Elemental	2(4.35%)	0(0.0%)	0(0.0%)	9(19.56%)	29(63.04%)	6(13.04%)
Bill of quantities	7(15.22%)	0(0.0%)	8(17.39%)	0(0.0%)	21(45.65%)	10(21.74%)
Other (please specify)						

2.5 What method do you use to determine the rates used to compile the estimates?(tick all to indicate the rates that are suitable with each method)

	Rates from previous, similar projects are suitably updated for inflation, site, market and conditions	Price books (e.g. Spon's price book, etc)	'Gut-feel' rates based on previous projects and experience	Rates are calculated for each new project from first principles	A library of rates kept from each previous project is put into a form which can be used for future projects	Other (specify)	missing
Functional unit	6(13.04%)	0(0.0%)	2(4.35%)	8(17.39%)	12(26.09%)	11(23.91%)	7(15.22%)
Superficial	2(4.35%)	1(2.17%)	0(0.0%)	3(6.52%)	7(15.22%)	7(15.22%)	26(56.52%)

Approximate quantities	2(4.35%)	5(19.87%)	3(6.52%)	10(21.74%)	8(17.39%)	4(17.35%)	14(30.43%)
Elemental	1(2.17%)	4(4.89%)	0(0.0%)	5(19.87%)	15(32.61%)	3(6.52%)	18(39.13%)
Bills of quantities	1(2.17%)	1(2.17%)	3(6.52%)	1(2.17%)	23(50.00%)	3(6.52%)	14(30.43%)
Other (please specify)							

2.6 The following questions are intended to identify the current practice of cost planning and control				
	YES	NO	N/A	missing
Do you set up a cost plan to control cost on projects	25(54.34%)	14(30.44%)	3(6.52%)	4(8.69%)
As part of the cost plan do you establish a cost limit with the client	31(67.39%)	8(17.39%)	3(6.52%)	4(8.69%)
Which of the following cost planning systems do you use?				
Elemental cost planning system (designing to cost)	31(67.39%)	8(17.39%)	3(6.52%)	4(8.69%)
Comparative cost planning system(costing a design)	23(50.00%)	6(13.04%)	13(28.26%)	4(8.69%)
If other (please elaborate)	23(50.00%)	11(23.91%)	8(17.39%)	4(8.69%)

2.7 At what stage of the project do you first establish the budget for the client? (tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Inception and brief	20(43.47%)	6(13.04%)	8(17.39%)	8(17.39%)	4(8.69%)
Feasibility	12(26.09%)	14(30.43%)	11(23.91%)	5(10.87%)	4(8.69%)
Sketch design	13(28.26%)	20(43.47%)	4(8.69%)	5(10.87%)	4(8.69%)
Detail design	16(34.78%)	9(19.56%)	5(10.87%)	12(26.09%)	4(8.69%)
Tender	19(41.30%)	4(8.69%)	8(17.39%)	11(23.91%)	4(8.69%)

2.8 At what stage of the project do you produce the first cost plan?(tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Inception and brief	6(13.04%)	5(10.87%)	20(43.48%)	11(23.91%)	4(8.69%)
Feasibility	8(17.39%)	12(26.08%)	17(36.96%)	5(10.87%)	4(8.69%)
Sketch design	16(34.78%)	17(36.96%)	3(6.52%)	6(13.04%)	4(8.69%)
Detail design	16(34.78)	18(39.13%)	3(6.52%)	5(10.87%)	4(8.69%)
Tender	20(43.48%)	6(13.04%)	8(17.39%)	8(17.39%)	4(8.69%)

2.9 Do you check the estimated cost against the cost plan (cost budget estimate) at the different stages?(tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	n /applicable	missing
Inception and brief	3(6.52%)	6(13.04%)	23(50.00%)	10(21.74%)	4(8.69%)
Feasibility	5(10.87%)	6(13.04%)	23(50.00%)	8(17.39%)	4(8.69%)
Sketch design	19(41.30%)	15(32.61%)	5(10.87%)	3(6.53%)	4(8.69%)
Detail design	30(65.22%)	8(17.39%)	2(4.35%)	2(4.35%)	4(8.69%)
Tender	29(63.04%)	3(6.53%)	4(8.69%)	6(13.04%)	4(8.69%)

2.10 If cost planning and cost control advice is not given, do any of the following reasons apply?(tick all as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Lack of time	7(15.21%)	11(23.91%)	19(41.30%)	5(10.87%)	4(8.69%)
Lack of expertise	5(10.87%)	0(0.0%)	29(63.04%)	8(17.39%)	4(8.69%)
Not financially viable	10(21.74%)	7(15.22%)	17(36.96%)	8(17.39%)	4(8.69%)
Not requested	15(32.6%)	12(26.08%)	8(17.39%)	7(15.22%)	4(8.69%)
Not in the scale of fees as a basic service	8(17.39%)	6(13.04%)	19(41.31%)	9(19.57%)	4(8.69%)
Size of project	6(13.04%)	11(23.91%)	18(39.13%)	7(15.22%)	4(8.69%)
Other (please specify)					

2.11 Please indicate your perception regarding the accuracy of methods used in providing the estimate of final building cost. (E.g., within 5% range).(assess all methods as appropriate)									
	within 5%	within 10%	Within 15%	within 20%	within 25%	within 30%	above 30%	don't know	missing
Functional unit	4(8.69%)	8(17.39%)	9(19.57%)	0(0.00%)	4(8.69%)	6(13.04%)	4(8.69%)	7(15.22%)	4(8.69%)
Superficial	8(17.39%)	12(26.09%)	0(0.00%)	10(21.74%)	4(8.7%)	0(0.00%)		3(6.52%)	4(8.69%)
Approximate quantities	7(15.22%)	19(41.31%)	4(8.69%)	0(0.00%)	5(10.87%)	2(4.35%)	2(4.35%)	3(6.52%)	4(8.69%)
Elemental	4(8.69%)	20(43.48%)	3(6.52%)	2(4.35%)	3(6.5%)	2(4.35%)	2(4.35%)	6(13.04%)	4(8.69%)
Bills of quantities	22(47.83%)	8(17.39%)	1(2.17%)	0(0.00%)	3(6.5%)	0(0.00%)	6(13.04%)	2(4.35%)	4(8.69%)
Other (please specify)									

2.12 What are the expected accuracy levels of your estimates at the various stages of the project listed below, relative to the accepted tender? (tick all stages as appropriate)									
	Within 5%	Within 10%	Within 15%	Within 20%	Within 25%	Within 30%	Above 30%	don't know	missing
Inception and brief	1(2.17%)	4(8.69%)	8(17.39%)	12(26.09%)	4(8.69%)	5(10.87%)	5(10.87%)	3(6.5%)	4(8.69%)
Feasibility	1(2.17%)	9(19.57%)	14(30.44%)	8(17.39%)	1(2.17%)	3(6.5%)	4(8.69%)	2(4.35%)	4(8.69%)
Sketch design	19(41.31%)	6(13.04%)	9(19.57%)	0(0.00%)	3(6.5%)	2(4.35%)	1(2.17%)	2(4.35%)	4(8.69%)
Detail design	15(32.61%)	16(34.78%)	4(8.69%)	1(2.17%)	0(0.00%)	0(0.00%)	4(8.69%)	2(4.35%)	4(8.69%)
Tender	27(58.69%)	8(17.39%)	2(4.35%)	0(0.00%)	0(0.00%)	0(0.00%)	1(2.17%)	4(8.69%)	4(8.69%)
Post-tender	20(43.48%)	6(13.04%)	1(2.17%)	0(0.00%)	0(0.00%)	0(0.00%)	4(8.69%)	11(23.91%)	4(8.69%)

2.13 Please indicate upon which of the following factors listed below, if any, does the accuracy of the estimate depend? (tick all factors as appropriate)					
	Always or frequently	occasionally	Seldom or never	don't know	missing
Estimating expertise	29(63.04%)	9(19.57%)	2(4.35%)	1(2.17%)	5(10.87%)
Good cost data base	37(80.43%)	0(0.00%)	4(8.69%)	1(2.17%)	4(8.69%)
Amount of design information available	40(86.96%)	0(0.00%)	0(0.00%)	2(4.35%)	4(8.69%)
Suitability of estimating method at different stages of the project	30(65.22%)	7(15.22%)	4(8.69%)	1(2.17%)	4(8.69%)
Chance	6(13.04%)	0(0.00%)	30(65.22%)	6(13.04%)	4(8.69%)
Method used	15(32.61%)	18(39.13%)	7(15.22%)	2(4.35%)	4(8.69%)
Other (please specify)					

SECTION THREE: RISK MANAGEMENT.

In implementing a formal risk management process, one has to quantify the risk factors /sources before a decision on budget is made. The factors to be quantified are the frequency of the risk, its impact on the budget and the response towards that risk for the purposes of risk mitigation. Below are three questions 3.1,3.2 and 3.3 that seek your assessment of your knowledge and experience on risk management.

In this section I am interested in obtaining your opinion on risk management decisions that you have made in your current project. Please, rank on a scale of 1-5, your assessment of risk frequency, impact and the typical response of the listed sources / factors as applied by you to real projects.

For each factor, fill in your assessment as indicated in each question.

			Q.3.1 Indicate the frequency with which the listed risk sources are relevant during the different stages of the project.						Q 3.2 Indicate the cost impact on the estimated cost plan (budget) of the listed risk sources / factors if they were to occur.					
Risk factors and sources			INCEPTION	FEASIBILITY	SKETCH DESIGN	DETAIL DESIGN	TENDER		INCEPTION	FEASIBILITY	SKETCH DESIGN	DETAIL DESIGN	TENDER	
Contract		Size of project	6(13.04%)	15(32.61%)	11(23.91%)	7(15.22%)	3(6.52%)		5(10.87%)	14(30.44%)	10(21.74%)	8(17.39%)	5(10.87%)	
		Complexity of project	5(10.86%)	18(39.13%)	10(21.74%)	6(13.04%)	3(6.52%)		6(13.04%)	17(36.96%)	8(17.39%)	5(10.87%)	6(13.04%)	
		Location of project	2(4.35%)	15(32.61%)	14(30.43%)	8(17.39%)	3(6.52%)		9(19.56%)	14(30.44%)	5(10.86%)	8(17.39%)	5(10.87%)	
		Conditions of contract	1(2.17%)	15(32.61%)	15(32.61%)	10(21.74%)	1(2.17%)		4(8.69%)	16(34.78%)	11(23.91%)	10(21.74%)	1(2.17%)	
		Type of procurement system	1(2.17%)	11(23.91%)	16(34.78%)	13(28.26%)	1(2.17%)		1(2.17%)	10(21.74%)	14(30.44%)	14(30.44%)	2(4.35%)	
Client / Professional. Team		Quality of design information	6(13.04%)	16(34.78%)	11(23.91%)	5(10.86%)	4(8.69%)		6(13.04%)	15(32.61%)	9(14.56%)	7(15.22%)	3(6.52%)	
		Design completeness	4(8.69%)	17(36.96%)	9(14.56%)	8(17.39%)	3(6.52%)		7(15.22%)	11(23.91%)	9(19.56%)	10(21.74%)	3(6.52%)	
		Type of client	2(4.35%)	17(36.96%)	11(23.91%)	8(17.39%)	3(6.52%)		1(2.17%)	8(17.39%)	18(38.13%)	11(23.91%)	2(4.35%)	
		Design variations	6(13.04%)	16(34.78%)	10(21.74%)	4(8.69%)	5(10.86%)		6(13.04%)	12(26.08%)	12(26.08%)	5(10.86%)	4(8.69%)	
		Brief uncertainty	8(17.39%)	15(32.61%)	5(10.86%)	9(14.56%)	4(8.69%)		8(17.39%)	13(28.26%)	11(23.91%)	5(10.86%)	2(4.35%)	
Estimating	Pre-tender	Experience of estimator	3(6.52%)	14(30.44%)	14(30.44%)	8(17.39%)	3(6.52%)		6(13.04%)	10(21.74%)	10(21.74%)	10(21.74%)	4(8.69%)	
		Expertise of estimator	4(8.69%)	15(32.61%)	11(23.91%)	7(15.22%)	3(6.52%)		4(8.69%)	12(26.08%)	10(21.74%)	9(19.56%)	5(10.86%)	
		Quality of estimating data	5(10.86%)	15(32.61%)	9(19.56%)	7(15.22%)	5(10.86%)		4(8.69%)	12(26.08%)	10(21.74%)	9(19.56%)	5(10.86%)	
		Type of estimate	2(4.35%)	15(32.61%)	9(19.56%)	9(19.56%)	3(6.52%)		8(17.39%)	14(30.44%)	8(17.39%)	7(15.22%)	3(6.52%)	
		Experience of quantity surveyor	8(17.39%)	13(28.26%)	11(23.91%)	5(10.86%)	4(8.69%)		12(26.08%)	13(28.26%)	8(17.39%)	4(8.69%)	3(6.52%)	
	Post-Tender	Timeous cost reports	2(4.35%)	16(34.78%)	5(10.86%)	8(17.39%)	10(21.74%)		3(6.52%)	13(28.26%)	9(19.56%)	11(23.91%)	4(8.69%)	
		Timeous completion of final account	6(13.04%)	9(19.56%)	5(10.86%)	12(26.08%)	9(19.56%)		4(8.69%)	9(19.56%)	6(13.04%)	12(26.08%)	9(19.56%)	
		Accurate progress payment valuations	5(10.86%)	10(21.74%)	6(13.04%)	11(23.91%)	9(19.56%)		1(2.17%)	7(15.22%)	6(13.04%)	15(32.61%)	11(23.91%)	
Project risks		Natural events (e.g. earthquakes)	7(15.22%)	11(23.91%)	5(10.86%)	10(21.74%)	8(17.39%)		2(4.35%)	10(21.74%)	13(28.26%)	11(23.91%)	4(8.69%)	
		Contract period overrun	1(2.17%)	9(19.56%)	11(23.91%)	10(21.74%)	9(19.56%)		1(2.17%)	6(13.04%)	13(28.26%)	13(28.26%)	7(15.22%)	
External factors		Inflation and market conditions/Tender conditions	2(4.35%)	16(34.78%)	7(15.22%)	8(17.39%)	7(15.22%)		2(4.35%)	12(26.08%)	12(26.08%)	8(17.39%)	6(13.04%)	
		Political uncertainties	3(6.52%)	18(39.13%)	8(17.39%)	8(17.39%)	3(6.52%)		2(4.35%)	18(39.13%)	13(28.26%)	3(6.52%)	4(8.69%)	
		Interest rate changes	1(2.17%)	20(43.3%)	5(10.86%)	8(17.39%)	6(13.04%)		2(4.35%)	13(28.26%)	17(36.96%)	4(8.69%)	4(8.69%)	

SECTION FOUR: TREATMENT OF POTENTIAL RISK

The intention of the following questions is to explore your opinions about the potential risk management techniques that may be applied by you during cost planning and control of building projects.

4.1 How familiar are you with the theory and practice of risk management?						
(a) Familiar with the theory	Yes	25(54.35 %)	No	14(30.43%)	missing	7(15.22%)
(b) Experienced in practice.	Yes	20(43.48%)	No	22(47.83%)	missing	4(8.69%)

4.2 What is your assessment of the potential of the estimating methods listed below to incorporate allowances for risk?(assess all methods as appropriate)					
	good	acceptable	poor	don't know	missing
Functional unit	3(6.52%)	11(23.91%)	23(50.00%)	5(10.89%)	4(8.69%)
Superficial	5(10.87%)	25(54.35%)	11(23.91%)	1(2.17%)	4(8.69%)
Approximate quantities	25(54.35%)	0(0.0%)	0(0.0%)	17(36.95%)	4(8.69%)
Elemental	20(43.48%)	15(32.60%)	4(8.69%)	3(6.52%)	4(8.69%)
Bills of quantities	39(84.78%)	0(0.0%)	0(0.0%)	3(6.52%)	4(8.69%)
Other (please specify)					

4.3 Do you use any of the following risk analysis techniques for assessing the risk component of the final building cost?(tick all techniques as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Intuition /judgement/ experience	28(60.86%)	0(0.0%)	11(23.91%)	3(6.52%)	4(8.69%)
Sensitivity analysis	3(6.52%)	7(15.22%)	14(30.43%)	18(39.13%)	4(8.69%)
Probability analysis	4(8.69%)	16(34.78%)	12(26.08%)	10(21.74%)	4(8.69%)
Monte Carlo simulation	1(2.17%)	3(6.52%)	13(28.26%)	25(54.34%)	4(8.69%)
Decision trees analysis	2(4.34%)	1(2.17%)	16(34.78%)	23(50.00%)	4(8.69%)
Utility theory analysis	2(4.34%)	1(2.17%)	18(39.13%)	21(45.65%)	4(8.69%)
Other(please specify)					

4.4 At what stages of the project would you implement the techniques listed below in risk analysis?(tick all techniques as appropriate)							
	inception & brief	feasibility	sketch design	detail design	tender	don't know	missing
Intuition/ judgement/ experience	11(23.91%)	2(4.34%)	4(8.69%)	15(32.61%)	8(17.39%)	2(4.34%)	4(8.69%)
Sensitivity analysis	1(2.17%)	0(0.0%)	2(4.34%)	10(21.74%)	3(6.52%)	26(56.52%)	4(8.69%)
Probability analysis	1(2.17%)	2(4.35%)	6(13.04%)	11(23.91%)	1(2.17%)	21(45.65%)	4(8.69%)
Monte Carlo simulation	1(2.17%)	2(4.35%)	0(0.0%)	0(0.00%)	4(8.69%)	35(76.08%)	4(8.69%)
Decision trees analysis	1(2.17%)	1(2.17%)	0(0.0%)	4(8.69%)	2(4.34%)	34(73.90%)	4(8.69%)
Utility theory analysis	1(2.17%)	0(0.0%)	0(0.0%)	1(2.17%)	7(15.22%)	33(71.72%)	4(8.69%)
Other(please specify)							

4.5 Do any of the factors listed below influence whether or not you apply risk evaluation techniques in cost planning?(tick all factors as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Lack of time	11(23.91%)	12(26.09%)	16(34.78%)	3(6.52%)	4(8.69%)
Lack of expertise	8(17.39%)	9(19.57%)	19(41.30%)	6(13.04	4(8.69%)
Not financially viable	9(19.56%)	15(32.61%)	13(28.26%)	5(10.87%)	4(8.69%)
Not requested	19(41.30%)	10(21.74%)	7(15.22%)	6(13.04%)	4(8.69%)
Size of project	12(26.09%)	10(21.73%)	12(26.08%)	8(17.39%)	4(8.69%)
Not in the schedule of basic services	11(23.91%)	7(15.21%)	16(34.78%)	8(17.39%)	4(8.69%)
Other (please specify)					

4.6 Do you communicate the extent of risk in the budget to the client during the various post-contract stages?(tick all methods of communication as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Reactively on request	16(34.78%)	19(41.30%)	5(10.87%)	2(4.35%)	4(8.69%)
Proactively before requested	14(30.42%)	19(41.30%)	5(10.87%)	4(8.69%)	4(8.69%)
Interactively as planned	15(32.61%)	16(34.78%)	7(15.22%)	4(8.69%)	4(8.69%)
Other (specify)					

QUESTIONNAIRE FOR THE ARCHITECTS

SUMMARY OF RESPONSE

SECTION ONE: DEMOGRAPHIC DATA

In this section you are requested to fill in details about your working environment. The information provided will only be used to identify and define the participants profile and to assist in data interpretation. Kindly place an "X"or a "TICK" in the appropriate spaces provided.

1.1 Which geographic area is your firm is situated?								
Nairobi	Mt.Kenya	Coast	Western	Nyanza	South Rift	North Rift	Northern Districts	missing
42(77.78%)	5(9.25%)							7(12.96%)

1.2 Please indicate the number of staff (according to category) in your organisation.								
	0-5	6-10	11-25	26-50	>50		Others (specify)	missing
Number of persons	20	16	7	0	1		0	10

1.3 Please indicate your number of years of working experience in the construction industry						
Years of experience	0-5	6-10	11-15	16-20	>21	missing
	1(1.85%)	10(18.52%)	10(18.52%)	12(28.22%)	14(25.92%)	7(12.96%)

1.4 Please indicate the firm's average gross annual turnover, in respect of building value, over the last 5 years.									
Kshs in Million	<2	2.1-5.0	5.1-10	10.1-25	25.1-50	50.1-100	100.1-150	>150.1	missing
	3(5.56 %)	3(5.56 %)	6(11.1%)	10(18.5 %)	10(18.5%)	8(14.81 %)	3(5.56 %)	4(7.41%)	7(12.96%)

1.5 Please indicate the value of your current public and private workload as a percentage of your total work value (Total of all cells to equal 100%).		
	Total workload 100%	missing
Housing	41 (75.95%)	13(24.07%)
Industrial	19(35.17%)	35(64.81%)

Commercial	28(51.83%)	26(48.15%)
Engineering	19(35.17%)	35(64.81%)
Renovation & Maintenance	32(59.26%)	22(40.74%)
Others (please specify)		

1.6 Please indicate which contract procurement methods you have been involved in over the past three years.		
	percentage of total	missing
Open tender	28(51.84%)	26(48.15%)
Selected tender	45(88.33%)	9(16.67%)
Negotiated contract	42(77.77%)	12(22.22%)
Other (please specify)	20(37.04%)	34(62.96%)

1.7 What type of documentation have you used in the contract procurement process over the past three years?		
	percentage of total	missing
Bills of quantities	45(83.33%)	9(16.67%)
Provisional bills	27(50.00%)	27(50.00%)
Schedules of rates	36(66.67%)	18(33.33%)
Other (please specify)	17(31.48%)	37(68.52)

SECTION TWO: COST BUDGET ESTIMATE / COST PLANNING AND CONTROL

The following questions are intended to identify the current estimating methods and the practice of cost planning and control as applied by you on real projects.

2.1 Do you appoint a quantity surveyor to your building project?					
	always or frequently	occasionally	seldom or never	n / applicable	missing
	22(40.74%)	0.00(0%)	24(44.44%)	1(1.86%)	7(12.96%)

2.2 If a quantity surveyor is employed, how is s/he appointed? (tick all appointing agent as appropriate)					
	always or frequently	occasionally	seldom or never	n / applicable	missing
Appointed by client	12(22.22%)	25(46.29%)	4(7.41%)	6(11.11%)	7(12.96%)
Appointed by architect	20(37.04%)	22(40.74%)	0(0.00%)	5(9.26%)	7(12.96%)
Other (please specify)					

2.3 Indicate the stage at which, the quantity surveyor, first becomes appointed in the project.(tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	n / applicable	missing
Inception and brief	13(24.07%)	14(25.93%)	12(22.22%)	8(14.81%)	7(12.96%)
Feasibility	10(18.52%)	21(38.89%)	6(11.11%)	10(18.52%)	7(12.96%)
Sketch design	16(29.63%)	20(37.64%)	3(5.56%)	8(14.81%)	7(12.96%)
Detail design	16(29.63%)	15(27.78%)	4(7.41%)	12(22.22%)	7(12.96%)
Tender	18(33.33%)	6(11.11%)	5)9.26%)	18(33.33%)	7(12.96%)

2.4 During the various stages of procurement process, how important to you are the cost estimates produced by the quantity surveyor? (tick all stages as appropriate)				
	vitally important	important	not important	missing
Inception and brief	15(27.78%)	12(22.22%)	17(31.48%)	10(18.51%)
Feasibility	14(25.93%)	25(46.29%)	5(9.26%)	10(18.52%)
Sketch design	24(44.44%)	18(33.33%)	2(3.70%)	10(18.51%)
Detail design	26(48.15%)	15(27.78%)	1(1.85%)	12(22.22%)
Tender	32(59.26%)	9(16.67%)	1(1.85%)	12(22.22%)

2.5 The following questions are intended to identify the current practice of cost budget planning and control in building projects.				
	YES	NO	N/A	missing
Do you set up a cost plan to control cost on projects	34(62.96%)	11(20.4 %)	2(3.70 %)	7(12.96%)
As part of the cost plan do you establish a cost limit with the client	41(75.93%)	3(5.56 %)	3(5.56 %)	7(12.96%)

Which of the following cost budget planning systems do you use?				
Elemental cost planning system (designing to cost)	25(46.29%)	9(16.67%)	13(24.1%)	7(12.96%)
Comparative cost planning system(costing a design)	27(50.00%)	10(18.5%)	10(18.5%)	7(12.96%)
If other (please elaborate)				

2.6 At what stage of the project do you receive information from the quantity surveyor to first establish the budget for the client? (tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Inception and brief	7(12.96%)	12(22.22%)	20(37.04%)	8(14.81%)	7(12.96%)
Feasibility	12(22.22%)	21(38.89%)	9(16.67%)	5(9.26%)	7(12.96%)
Sketch design	20(37.04%)	17(31.48%)	6(11.11%)	4(7.41%)	7(12.96%)
Detail design	21(38.89%)	11(20.37%)	6(11.11%)	9(16.67%)	7(12.96%)
Tender	25(46.29%)	4(7.41%)	7(12.96%)	11(20.37%)	7(12.96%)

2.7 At what stage of the project do you first receive information from the quantity surveyor relating to the cost budget?(tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Inception and brief	5(9.26%)	10(18.52%)	22(40.74%)	10(18.52%)	7(12.96%)
Feasibility	13(24.07%)	19(35.18%)	9(16.67%)	6(11.11%)	7(12.96%)
Sketch design	22(40.74%)	19(35.18%)	1(1.86%)	5(9.26%)	7(12.96%)
Detail design	24(44.44%)	11(20.37%)	4(7.41%)	8(14.81%)	7(12.96%)
Tender	24(44.44%)	6(11.11%)	5(9.26%)	12(22.22%)	7(12.96%)

2.8 These questions relate to cost planning and control of building projects.				
	Yes	no	n/applicable	missing
Are you aware of the concept of cost planning and control of building projects?	45(83.33%)	1(1.85%)	1(1.85%)	7(12.96%)
Was the service of cost planning and control offered to you?	31(57.41%)	14(25.93%)	2(3.71%)	7(12.96%)
Did you make yourself available for the service of cost planning and control?	36(66.67%)	7(12.96%)	4(7.41%)	7(12.96%)

2.9 At what stage do you first receive the detailed cost plan from the quantity surveyor?(tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	n /applicable	missing
Inception and brief	10(18.52%)	4(7.41%)	18(33.33%)	15(27.78%)	7(12.96%)
Feasibility	7(12.96%)	13(24.07%)	15(27.78%)	12(22.22%)	7(12.96%)
Sketch design	11(20.37%)	21(38.89%)	6(11.11%)	9(16.67%)	7(12.96%)
Detail design	22(40.74%)	12(22.22%)	5(9.26%)	8(14.81%)	7(12.96%)
Tender	23(42.59%)	5(9.26%)	4(7.41%)	15(27.78%)	7(12.96%)

2.10 Do you check the estimated cost against the cost plan (cost budget estimate) at the different stages? (tick all stages as appropriate)					
	always or frequently	occasionally	seldom or never	n /applicable	missing
Inception and brief	9(16.67%)	7(12.96%)	17(31.48%)	14(25.98%)	7(12.96%)
Feasibility	8(14.81%)	16(29.63%)	13(24.07%)	10(18.52%)	7(12.96%)
Sketch design	13(24.07%)	22(40.74%)	6(11.11%)	6(11.11%)	7(12.96%)
Detail design	26(48.14%)	13(24.07%)	5(9.26%)	3(5.56%)	7(12.96%)
Tender	28(51.86%)	8(14.82%)	3(5.56%)	8(14.82%)	7(12.96%)

2.11 What accuracy levels of estimates do you expect from the quantity surveyor at the various stages of the project listed below, relative to the accepted tender? (e.g. within a percentage range)									
	Accuracy level expected								
	within 5%	within 10%	within15 %	within 20%	within 25%	within 30%	Above 30%	don't know	missing
Inception and brief	2(3.71 %)	1(1.86 %)	8(14.8 %)	10(18.52 %)	11(20.37 %)	2(3.7 %)	4(7.41 %)	9(16.67 %)	7(12.96 %)
Feasibility	2(3.71 %)	10(18.5 %)	12(22.22 %)	0(0.0 %)	8(14.81 %)	4(7.41 %)	7(12.96 %)	7(12.96 %)	7(12.96 %)

Sketch design	10(18.5 %)	14(25.9 %)	12(22.23 %)	0.00 %)	4.(7.41 %)	1(1.85 %)	3(5.56 %)	3(5.56 %)	7(12.96 %)
Detail design	8(14.82 %)	16(29.6 %)	6(11.1 %)	5(9.26 %)	4(7.41 %)	0(0.0 %)	5(9.26 %)	3(5.56 %)	7(12.96 %)
Tender	18(33.33 %)	13(24.07 %)	4(7.41 %)	3(5.55 %)	2(3.70 %)	1(1.85 %)	4(7.41 %)	2(3.71 %)	7(12.96 %)
Post - tender	21(38.89 %)	8(14.81 %)	2(3.71 %)	2(3.71 %)	3(5.56 %)	0(0.00 %)	3(5.56 %)	8(14.8 %)	7(12.96 %)

2.12 What accuracy levels of estimates do you receive from the quantity surveyor at the various stages of the project listed below, relative to the accepted tender? (e.g. within a percentage range)									
	Accuracy level received								
	Within 5%	Within1 0%	Within1 5%	Within2 0%	Within 25%	Within3 0%	Above 30%	don't know	missing
Inception and brief	1(1.85 %)	0(0.0 %)	7(12.96 %)	9(16.67 %)	6(11.11 %)	2(3.70 %)	10(18.52 %)	12(22.22 %)	7(12.96 %)
Feasibility	6(11.11 %)	12(22.22 %)	6(11.11 %)	0(0.0 %)	6(11.11 %)	3(5.56 %)	5(9.26 %)	9(16.67 %)	7(12.96 %)
Sketch design	1(1.85 %)	9(16.67 %)	11(20.37 %)	10(18.52 %)	6(11.11 %)	0(0.0 %)	5(9.26 %)	5(9.26 %)	7(12.96 %)
Detail design	12(22.2 %)	6(11.11 %)	9(16.67 %)	6(11.11 %)	3(5.56 %)	2(3.71 %)	4(7.41 %)	5(9.26 %)	7(12.96 %)
Tender	15(27.78 %)	10(18.52 %)	7(12.96 %)	6(11.11 %)	2(3.71 %)	1(1.85 %)	3(5.56 %)	3(5.56 %)	7(12.96 %)
Post-tender	16(29.62 %)	10(18.52 %)	4(7.41 %)	4(7.41 %)	3(5.56 %)	1(1.85 %)	2(3.71 %)	7(12.96 %)	7(12.96 %)

SECTION THREE: RISK MANAGEMENT.

In implementing a formal risk management process, one has to quantify the risk factors sources before a decision on budget is made. The factors to be quantified are the frequency of the risk, its impact on the budget and the response towards that risk for the purposes of risk mitigation. Below are three questions (3.1,3.2 and 3.3) that seek your assessment of your knowledge and experience on risk management.

In this section, I am interested in obtaining your opinion on risk management decisions that you have made in your current project. Please, rank on a scale of 1-5, your assessment of risk frequency, impact and the typical response of the listed risk sources / factors as applied by you to real projects.

Rank on a scale of 1-5, your assessment of risk frequency, impact and the typical response of the listed risk sources / factors as applied by you to real projects.

For each factor / section, fill in your assessment as indicated in each question. You may rank each project development stage differently, between 1-5.

Rank from 1-5 the following risk factors / sources to indicate your assessment/ opinion in the proceeding columns		Q.3.1 Indicate the frequency with which the listed risk sources are relevant during the different stages of the project.						Q 3.2 Indicate the cost impact on the estimated cost plan (budget) of the listed risk sources / factors if they were to occur.						Q 3 sou (5-r &re 3-tr.
Risk factors and sources		INCEPTION	FEASIBILITY	SKETCH DESIGN	DETAIL DESIGN	TENDER		INCEPTION	FEASIBILITY	SKETCH DESIGN	DETAIL DESIGN	TENDER		Retain & increase
Contract	Size of project	5(9.2 %)	14(26.91 %)	20(37.04 %)	4(7.41 %)	3(5.56 %)		4(7.4 %)	15(27.7 %)	19(35.98 %)	5(9.25 %)	3(5.56 %)		5(9. %)
	Complexity of project	5(9.2 %)	18(33.33 %)	15(27.7 %)	5(9.2 %)	3(5.56 %)		5(9.2 %)	11(20.3 7%)	22(40.74 %)	5(9.2 %)	3(5.56 %)		6(1 %)
	Location of project	3(5.56 %)	10(18.52 %)	18(33.33 %)	8(14.81 %)	5(9.2 %)		!(1.85 %)	11(20.3 7%)	21(38.89 %)	8(14.81 %)	3(5.56 %)		4(7. %)
	Conditions of contract	4(7.41 %)	6(11.11 %)	18(33.33 %)	5(9.25 %)	7(12.9 6%)		4(7.41 %)	11(20.3 7%)	19(35.18 %)	9(16.67 %)	3(5.56 %)		5(9. %)

		Type of procurement system	2(3.71%)	12(22.22%)	16(29.63%)	13(24.07%)	3(5.56%)		2(3.71%)	5(9.2%)	26(48.15%)	10(18.52%)	3(5.56%)		5(9.%)
Client / Professional. Team		Quality of design information	2(3.71%)	4(7.41%)	12(22.22%)	20(37.04%)	8(14.81%)		3(5.56%)	15(27.78%)	15(27.78%)	8(14.81%)	3(5.56%)		3(5.%)
		Design completeness	4(7.4%)	12(22.22%)	16(29.63%)	7(12.96%)	5(9.2%)		4(7.4%)	13(24.07%)	10(18.52%)	11(20.37%)	3(5.56%)		5(9.%)
		Type of client	1(1.85%)	11(20.37%)	18(33.33%)	6(11.11%)	7(12.96%)		3(5.56%)	12(22.22%)	12(22.22%)	11(20.37%)	3(5.56%)		2(3.%)
		Design variations	5(9.2%)	10(18.52%)	18(33.33%)	7(12.96%)	2(3.71%)		5(9.2%)	12(22.22%)	10(18.52%)	6(11.11%)	6(11.11%)		6(1%)
		Brief uncertainty	1(1.85%)	12(22.22%)	15(27.78%)	9(16.67%)	6(11.11%)		3(5.56%)	6(11.11%)	20(37.04%)	10(18.52%)	3(5.56%)		4(7.%)
Estimating	Pre-tender	Experience of estimator	2(3.71%)	9(16.67%)	23(42.59%)	7(12.96%)	2(3.71%)		2(3.71%)	8(14.81%)	14(26.91%)	11(20.37%)	7(12.96%)		4(7.%)
		Expertise of estimator	7(12.96%)	11(20.37%)	8(14.81%)	12(22.22%)	3(5.56%)		4(7.4%)	7(12.96%)	19(35.18%)	10(18.52%)	2(3.71%)		4(7.%)
		Quality of estimating data	5(9.2%)	11(20.37%)	16(29.63%)	5(9.26%)	5(9.26%)		2(3.71%)	15(27.78%)	11(20.37%)	10(18.52%)	3(5.56%)		4(7.%)
		Type of estimate	4(7.4%)	12(22.22%)	13(24.07%)	7(12.96%)	4(7.4%)		2(3.71%)	11(20.37%)	9(16.67%)	8(14.81%)	9(16.67%)		5(9.%)
		Experience of Architect	3(5.56%)	9(16.67%)	8(14.81%)	14(26.91%)	6(11.11%)		5(9.26%)	10(18.52%)	17(31.48%)	7(12.96%)	3(5.56%)		3(5.%)
		Timeous cost reports	6(11.11%)	9(16.67%)	14(26.91%)	8(14.81%)	3(5.56%)		1(1.85%)	6(11.11%)	13(24.07%)	17(31.48%)	4(7.4%)		3(5.%)
	Post-Tender	Timeous completion of final account	2(3.71%)	9(16.67%)	8(14.81%)	14(26.91%)	8(14.81%)		4(7.4%)	6(11.11%)	7(12.96%)	17(31.48%)	8(14.81%)		5(9.%)
		Accurate progress payment valuations	2(3.71%)	8(14.81%)	7(12.96%)	18(33.33%)	6(11.11%)		4(7.4%)	6(11.11%)	6(11.11%)	18(33.33%)	7(12.96%)		2(3.%)
Project risks		Natural events (e.g. earthquakes)	5(9.26%)	7(12.96%)	14(26.91%)	12(22.22%)	4(7.4%)		3(5.56%)	12(22.22%)	8(14.81%)	15(27.78%)	4(7.4%)		4(7.%)
		Contract period overrun	3(5.56%)	7(12.96%)	12(22.22%)	14(26.91%)	6(11.11%)		7(12.96%)	7(12.96%)	10(18.52%)	11(20.37%)	7(12.96%)		3(5.%)
External factors		Inflation and market conditions/ Tender conditions	1(1.85%)	4(7.4%)	8(14.81%)	19(35.18%)	10(18.52%)		5(9.26%)	9(16.67%)	19(35.18%)	7(12.96%)	2(3.71%)		6(1%)
		Political uncertainties	2(3.71%)	7(12.96%)	13(24.07%)	15(27.78%)	5(9.26%)		4(7.4%)	7(12.96%)	16(29.63%)	12(22.22%)	2(3.71%)		5(9.%)
		Interest rate changes	4(7.4%)	6(11.11%)	18(33.33%)	5(9.26%)	7(12.96%)		1(1.85%)	9(16.67%)	12(22.22%)	12(22.22%)	6(11.11%)		1(1.%)

SECTION FOUR: TREATMENT OF POTENTIAL RISK

The intention of the following questions is to explore your opinions about the potential risk management techniques that may be applied by you during cost budget planning and control of building projects.

4.1 How familiar are you with the theory and practice of risk management?						
(a) Familiar with the theory	Yes	25(46.29%)	No	20(37.04%)	missing	9(16.67%)
(b) Experienced in practice.	Yes	25(46.29%)	No	20(37.04%)	missing	9(16.67%)

4.2 What is your assessment of the potential of the various estimating methods listed below to incorporate allowances for risk? (assess all methods as appropriate)					
	good	acceptable	poor	don't know	missing
Functional unit	9(16.67%)	20(37.04%)	9(16.67%)	9(16.67%)	7(12.96%)
Superficial	5(9.26%)	15(27.78%)	21(38.89%)	6(11.11%)	7(12.96%)
Approximate quantities	14(25.93%)	20(37.04%)	9(16.67%)	4(7.41%)	7(12.96%)
Elemental	13(24.07)	19(35.18%)	7(12.96%)	8(14.8%)	7(12.96%)
Bills of quantities	31(57.41%)	9(16.67%)	2(3.70%)	5(9.26%)	7(12.96%)
Other (please specify)					

4.3 Do you expect the quantity surveyor to use any of the following risk analysis techniques for assessing the risk component of the final building cost? (tick all techniques as appropriate)					
	always or frequently	occasionally	seldom or never	don't know	missing
Intuition/ judgement/ experience	27(50.00%)	10(18.52%)	5(9.26%)	5(9.26%)	7(12.96%)
Sensitivity analysis	10(18.52%)	16(29.63%)	10(18.51%)	11(20.37%)	7(12.96%)
Probability analysis	6(11.11%)	18(33.33%)	14(25.93%)	9(16.67%)	7(12.96%)
Monte Carlo simulation	3(5.56%)	10(18.52%)	8(14.82%)	26(48.15%)	7(12.96%)
Decision trees analysis	6(11.11%)	10(18.52%)	8(14.82%)	23(42.59%)	7(12.96%)
Utility theory analysis	12(22.22%)	10(18.52%)	4(4.41%)	21(38.89%)	7(12.96%)
Other(please specify)					

4.4 At what stages of the project would you expect the quantity surveyor to implement the techniques listed below in risk analysis? (tick all techniques as appropriate)							
	inception & brief	feasibility	sketch design	detail design	tender	don't know	missing
Intuition/ judgement/ experience	2(3.71%)	2(3.71%)	6(11.11 %)	18(33.34%)	11(20.37%)	8(14.82 %)	7(12.96 %)
Sensitivity analysis	2(3.71%)	11(20.37%)	6(11.11 %)	5(9.26%)	10(18.52%)	13(24.07%)	7(12.96 %)
Probability analysis	1(1.85%)	1(1.85%)	8(14.82 %)	14(25.93%)	11(20.37%)	12(22.22%)	7(12.96 %)
Monte Carlo simulation	5(9.26%)	4(7.41%)	4(7.41%)	2(3.71%)	4(7.41%)	28(51.8 %)	7(12.96 %)
Decision trees analysis	2(3.71%)	6(11.11 %)	4(7.41%)	4(7.41%)	3(5.56%)	28(51.8 %)	7(12.96 %)
Utility theory analysis	1(1.85%)	3(5.56%)	7(12.96 %)	8(14.82 %)	6(11.11 %)	22(40.74%)	7(12.96 %)
Other(please specify)							

4.5 Is the extent of risk in the budget communicated to you by the quantity surveyor or to the client by you during the various post-contract stages?					
	always or frequently	occasionally	seldom or never	don't know	missing
Reactively on request	19(35.18%)	16(29.63%)	6(11.11%)	6(11.11%)	7(12.96%)
Proactively before requested	12(22.23%)	18(33.34%)	8(14.82%)	9(16.67%)	7(12.96%)
Interactively as planned	17(31.48%)	12(22.23%)	9(16.67%)	9(16.67%)	7(12.96%)
Other (specify)					